LINKING ENGINEER CAREER ORIENTATION AND HUMAN RESOURCE MANAGEMENT PRACTICES: DOES FIT AFFECT RETENTION?

THESIS

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Abstract

Turnover of the Air Force civil engineering (CE) officers is becoming increasingly important, as levels of CE Captains consistently decreases. Allen and Katz (1986) identified three career orientations of engineers based on their job preference—project, professional, and management engineers. Shepard (1958) suggested a dual-ladder promotion system to meet the career desires of technical and management workers. Additional research has proposed "desired" Human Resource Management (HRM) practices to facilitate the retention of each type of career-based engineer (Lee and Maurer, 1997). In an effort to determine if these career orientations, along with Air Force HRM practices, were linked to declining retention, a survey was sent to 927 company grade CE officers to measure these and other variables of interest including career satisfaction, perceived organizational support and participant's intent to remain in the Air Force.

Results of the analysis revealed 50 percent of the 443 respondents were management oriented, while only 37 percent of the respondents were project oriented and 13 percent professional oriented. Management oriented CE officers reported higher levels of career satisfaction and intent to remain in the Air Force than the other two orientations. Respondents across all orientations perceived a significantly lower opportunity for training and development and career progression than they desired. Regression analysis revealed career satisfaction to be a significant predictor of career intent, while career planning and perceived organizational support were significant

predictors of career satisfaction. Additionally, moving from lieutenant to captain rank resulted in a decrease in project oriented officers and an increase in management oriented officers. These findings suggest that career orientation and HRM practices are important considerations for improving the retention of Air Force CE company grade officers.

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I. Introduction

1.1 Background

Turnover in the Air Force has always been a subject of importance. Turnover generally requires that replacements be recruited, trained, and given time to gain proficiency on the job- all of which represent costs to the organization. As the costs associated with losing an individual are high, it would be in the best interest of an organization to determine the extent to which their efforts to retain workers are effective.

"Knowledge" workers are defined as those who add value to an organization because of what they know (Lee and Maurer, 1997:248). Examples of knowledge workers are scientists, engineers, accountants, and ecologists. For the purpose of this research effort, knowledge workers will refer to engineers. The organizational retention of knowledge workers is of high interest because in addition to the high financial cost of replacing a worker there is the loss of substantial technical knowledge. For these reasons, research addressing the retention of knowledge workers is on the rise.

Knowledge workers, for this research, are defined as Air Force Company Grade Officers (CGOs) with an Air Force Specialty Code of 32EXX, the Civil Engineer (CE) career field. According to Air Force Personnel Center statistics, as of March 1999 the

percentage of authorized CE positions that were filled by assigned personnel were Lieutenants, 162%, Captains, 79%, Majors, 112%, and Lieutenant Colonels, 83%. By July 1999 these had changed to Lieutenants, 143%, Captains, 87%, Majors, 101%, and Lieutenant Colonels, 113%. In the comparison of the actual percentages there is a consistently lower percentage for Captains than any other rank. Therefore, this research effort will investigate one possible reason that Civil Engineering Lieutenants are leaving the Air Force: the failure of human resource management (HRM) practices to meet the needs of Civil Engineer Officers based on their individual career orientation.

Allen and Katz (1986) classified engineers into three taxonomic types: 1) engineers oriented toward a technical career, 2) engineers oriented toward a management career, and 3) engineers oriented toward a project-centered career. Lee and Mitchell's (1994) unfolding model of voluntary turnover states that there are four prototypical ways in which individuals might leave their organization. The career-orientation classification of engineers and Lee and Mitchell's (1994) unfolding model of voluntary turnover were combined by Lee and Maurer (1997) in an effort to explain the retention of knowledge workers. By applying these four voluntary turnover "decision paths", Lee and Maurer (1997:247) created four matrices in which five "standard" HRM functions were crossed with each type of engineer. The five "standard" HRM functions that Lee and Maurer used were: 1) staffing, 2) compensation, 3) grievance procedures, 4) training and development, and 5) career planning. The research concluded with the determination of how each type of HRM function facilitates the retention of a specific type of engineer. This research investigates only three of the five HRM functions, therefore, Table 1.1 details the matrix in the areas of three prominent human resource management practices-

staffing, training and development, and career planning. Compensation and grievance procedures are not examined here as there is less variation in these areas, since pay is based on rank and grievance channels are similar throughout the Air Force for CGOs.

Table 1.1 Lee and Maurer (1997) Desired Human Resource Management Practices by Engineer Type

Engineer Type	Staffing	Training and Development	Career Planning
Project-Oriented	- Offer successive and increasingly challenging project contracts	- Offer project-specific learning	- Establish technical career ladders
Profession-Oriented	- Offer successive and increasingly challenging assignments - Offer realistic job previews about the engineer's role within the firm	- Offer opportunity to earn an MS in Engineering or Joint MS-MBA Degree	- Establish technical career ladders
Management-Oriented	- Offer realistic job previews about managerial opportunities - At the firm level, identify managerial career paths; at the individual level, set realistic expectations about career progression	- Offer opportunity to Earn an MBA, Executive MBA, or Executive Certificate	- Slot into virtually any upward career path - Establish managerial career ladder

1.2 Problem Statement

Currently, the Air Force is undermanned in the rank of Captain in the Civil Engineer career field indicating Lieutenants are leaving the career field at a higher rate than recruitment forecasted. To investigate this phenomenon, this research will examine the relationship between current Air Force HRM practices and "desired" (Lee and Maurer, 1997: 255-258) standard HRM practices as applied to the retention of knowledge workers. If a mismatch exists between current Air Force HRM practices and the prevailing career orientation of its civil engineer CGOs, general conclusions can be drawn regarding the turnover of Lieutenants in the Civil Engineer career field.

1.3 Research Objectives

In order to investigate the extent to which current Air Force HRM practices are meeting the actual needs of the CE officer workforce, there are three research questions that must be addressed:

Research Question #1
Is Allen and Katz's (1986) classification of engineers into three taxonomic types: 1) project, 2) professional, and 3) management applicable to Air Force CE CGOs?

Research Question #2
Will the comparison of the "desired" standard HRM practices and the current AF HRM practices, as applied to the retention of knowledge workers in the areas of staffing, training, and career planning, result in a mismatch ?

Research Question #3
If the comparison, of desired and current AF HRM practices, results in a mismatch, is there an effect on career satisfaction and negative retention of CE CGOs?

Chapter 2 reviews literature on engineer career orientation, human resource management practices, and the combination of the two to focus on knowledge worker

retention. Chapter 3 discusses the methodology used in this research effort, detailing the survey and measure construction. In Chapter 4 the results of the data analysis are given. Finally, Chapter 5 is the discussion of the results, conclusions, and implications for future research.

II. Literature Review

2.1 Overview

This chapter will address the literature on the subject of engineer careers. First, the career orientation of engineers and its related theory is detailed. Included is an explanation of Dual Ladder Theory, the base theory for proposing reward for engineers in both a management and technical element. Additionally, the concept of three engineer career orientations, management, professional, and project is presented. Second, an in-depth look at human resource management in the areas of staffing, training and development, and career planning is accomplished. Third, current Air Force human resource management practices, as applied to Civil Engineer Officers, are detailed. Fourth, the topics of career satisfaction and perceived organizational support are detailed. Finally, the application of human resource management to the retention of knowledge workers is addressed.

2.2 Engineer Career Orientation

"Industry has become increasingly dependent on technological innovation as an instrument of competition" (Shepard, 1958:511). The previous quote has tremendous longevity as it still holds true today. With industry so dependent on continuous technical innovation so becomes an organization's reliance on the knowledge worker. Therefore, research has looked to encompass a better understanding of the knowledge worker.

In a technical organization, the management class presides over the activities of scientists and engineers. Therefore, it makes sense to groom those who possess technical competence for management positions. In fact, many organizations expect those with

technical competence to move into management positions as their careers progress. Normally, when knowledge workers are moved to management they lose direct contact with technical work and become increasingly involved with many non-technical matters. While this is not a problem for those who are interested in management, technical professionals that are not interested in becoming managers often see limitations to their careers.

This phenomena has been recognized and the problem of finding a way of rewarding knowledge workers for good technical performance without removing them from their technical work has been addressed. Two approaches to this problem are 1) emphasis of the concept of technical direction and 2) development of a "technical ladder"(Shepard, 1958:512). In the first approach, emphasizing technical direction is obtained by assigning administrative assistants to help knowledge workers. This allows knowledge workers to spend more of their time controlling technical activities and furthering their technical competence. An alternative method of rewarding the knowledge worker is the development of a technical ladder.

The development of a technical ladder approach encompasses paralleling the positions of the management ladder. (Figure 2.1)

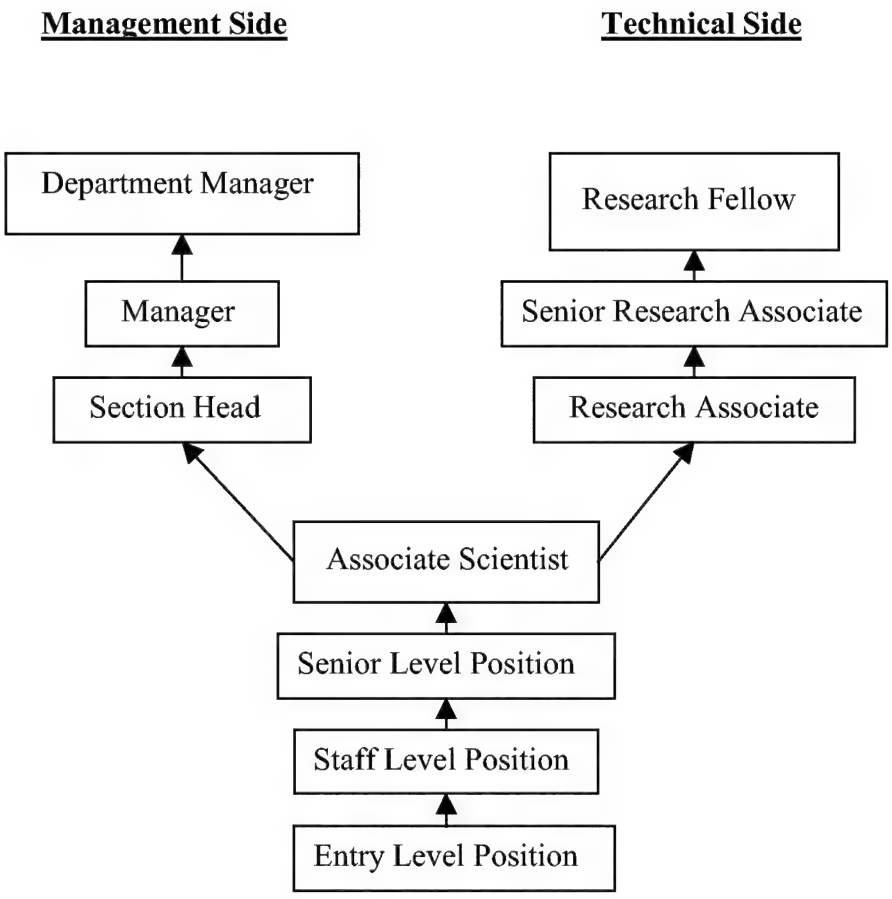


Figure 2.1 An Example of the Dual Ladder
(Sacco and Knopka 1983:38)

> No managerial responsibilities encumber the freedom of persons occupying these positions...making it possible to give recognition and reward to scientists who do outstanding work by promoting them in the technical ladder, at the same time providing them the opportunity to continue scientific work. (Shepard, 1958:512)

The dual ladder is a set of positions, for professionals, that is designed to parallel the advancement ladder of management. There are several variations of this approach, however, they all have the same basis of acquiring and maintaining knowledge workers by rewarding them with the same prestige, freedom and job luxuries as experienced by the traditional progression in management. For example, where upward mobility

through management has been traditionally linked with the best office, perhaps a parallel rung on the technical ladder would lead to the same "valued item."

Smith and Szabo (1977) applied the dual ladder theory to a research and development department of the Union Carbide Corporation. An interesting variation to the early implementation of the dual ladder system was the consideration of making lowest position on either ladder equal in status and in opportunity to choose either tract. Therefore, a conscious effort was made to not pigeonhole a knowledge worker into one ladder without any experience on which to base their choice. The result of this effort was the inclusion of a crossover between scientific and management ladders at a lower level. The "project scientist" position acted as the gateway position to progression up either the management ladder or the technical ladder. Early research continued to refine the classification system, adding the concept of engineer career-orientation classification for the purpose of designing an appropriate reward system for knowledge workers.

The research of Von Glinow (1988) identified several characteristics distinctive to knowledge workers. First, knowledge workers enjoy being intellectually and technically challenged. Knowledge workers also tend to identify more with their profession or technology than with their employing organization due to their large investment in personal training and skills. Additionally, knowledge workers enjoy independence, which may serve as a major factor in reward determination. Knowledge workers also tend to have strong ethics and internal work standards. These identified characteristics tend to mitigate traditional forms of performance appraisal and reward systems as their characteristics vary significantly from other workers. Therefore, the effectiveness of the

dual ladder reward system has been questioned on many occasions and research has delved into trying to better understand what can be done to reward and motivate knowledge workers.

Allen and Katz (1986) conducted a survey in which technical staff responded to questions regarding career preference. The engineer preferences were grouped into three categories: 1) those that favored management, 2) those that favored the technical ladder, or 3) those that favored project assignments regardless of promotion. The survey population was chosen to represent several distinct areas of the high-tech field by sending out surveys to engineers and scientists in nine major U.S. organizations. The central questions, determining career preference, in the survey are shown in Table 2.1. A 7-point Likert scale (1-strongly disagree to 7- strongly agree) was used to determine each respondents' preference for progression through three distinct career orientations.

Table 2.1 Allen and Katz (1986) Survey Questions Determining Career Preference

To what extent would you like your career to be:
a) a progression up the technical professional ladder to a higher-level position?
b) a progression up the managerial ladder to a higher level position?
c) the opportunity to engage in those challenging and exciting research activities and projects with which you are most interested, irrespective of promotion?

(Allen and Katz, 1986:187)

A group of 2,157 engineers completed the questionnaires with 32.6% of the respondents preferring the managerial ladder, 21.6% preferring the technical ladder, and 45.8% preferring project assignments. Allen and Katz (1986) used these results to

identify and define three career-based engineer prototypes: 1) project engineer, 2) professional engineer, and 3) management engineer.

Lee and Maurer (1997) provide the clearest definitions of all three career-based engineer types. A project engineer is a person that is primarily project-oriented and can be described as more involved with and attached to a specific project than the profession of engineering or their employing organization. Conversely, a professional engineer is a person that is primarily profession-oriented and can be described as more involved and attached to the professional norms and ethics, and the role of engineering than a specific project or employing organization. Whereas, a management engineer is a person that is primarily oriented towards management and can be described as more involved and attached to the role of manager than a specific project or employing organization. This research effort intends to show that these career-based engineer types are applicable and evident in Air Force CE CGOs. Therefore, the null hypothesis below was tested:

> *Hypothesis 1: In the application of Allen and Katz's (1986) three taxonomic engineer types to Air Force CE CGOs, there is no difference in career orientations in Air Force CE CGOs.*

With the identification of three engineer types, the theory in which the reward or motivation of engineers continues to become further refined. To understand the relationship between engineer career orientation and retention, human resource management practices must be addressed. Human resource management and its executed practices are the means of addressing reward, motivation, and retention within an organization.

2.3 Human Resource Management

> To get results of technical innovation into the commercial use requires organization and a cast of support personnel- engineers, technicians, assemblers, paper handlers, and managers. The ability of firms, industries, and, indeed the United States as a whole to compete effectively…hinges on a broad spectrum of human skills and on crucial organizational decisions affecting their deployment. (Kleingarter and Anderson, 1987:preface)

Human resource management practices in high-technology firms are derived in part from management needs. The management needs that govern practices in high-technology firms include: 1) the need to recruit the professional segment of the high technology work force, 2) the need to maintain an employee's commitment to the organization, 3) the need to provide employee's with incentives and job security, and 4) the need to foster employee productivity in innovation and development (Kleingartner and Anderson, 1987:10). Therefore, the development of human resource management practices are driven to ensure professional productivity, where productivity is defined as the demand that sets forth the need to properly address all aspects of employees in an effort to ensure the effectiveness of workers (Kleingartner and Anderson, 1987:10).

Included in the general complexity of high technology are global competition and technological change (Miljus and Smith, 1987:115). The pace of technological change can be overwhelming as demonstrated with engineers becoming technically obsolete less than three years after completing an undergraduate engineering program and with the life cycles of products in high technology continuing to shrink. What exists in high technology industries that might not necessarily exist in other industries is the effect of an

internal force of change. The internal force of change originates from the organization's human resources (Miljus and Smith, 1987:116).

Human resource professionals can best contribute to the organization's success by acknowledging these aspects of change and by working with line management to implement organizational processes to address the complex personnel issues in high-tech organizations. To assess the current role of human resource management professionals, Milijus and Smith (1987) conducted interviews of 24 human resource managers. Seventeen of the survey participants were from high-technology organizations. The interviews were exploratory in nature with the focus on the human resource managers' perception of relevant external environmental forces and the key personnel issues confronting their particular firms. The high priority issues emphasized consistently by a majority of interviewees were 1) recruitment and staffing; 2) training and development, and; 3) organization design and development.

For the purpose of this research effort, organization design and development will be omitted from any further detail. Since the beginning of the Air Force, organizational design and structure has been a top concern resulting in many changes over the years to adopt force structure changes. However, in this research effort, structure has not been linked to retention and career orientation is an individual level attribute. Since the Air Force has addressed organizational structure trends with changes over the years this study will focus on an area where current research has not been applied to the military. Additionally, the intent of this effort is to focus on the differential effort of item practices on each engineer type. Therefore, the next three sections will detail three prominent

human resource management practices: staffing, training and development, and career planning.

2.3.1 Staffing. Staffing is defined as the critical need to attract and properly place high-talent personnel, or in the case of this study knowledge workers, throughout the organization (Leap and Crino, 1993:171). Staffing generally includes the personnel activities of employment planning, recruitment, and hiring. However, the personnel activity of employment planning will be the only activity further detailed in this study, because the areas of recruitment and hiring are beyond the scope of the research objectives stated in Chapter 1.

Employment planning includes the estimation of the number of qualified people needed to carry out the organization's mission. Additionally, employment planning includes determining how many people will be available and ensuring that the current supply of human resources will meet the organization's future demand for personnel (Leap and Crino, 1993:172). Due to the nature of the activities involved in employment planning, it is considered a dynamic and ongoing process.

Table 2.2 Lee and Maurer (1997) Desired Career Planning Practices by Career Orientation

Career Orientation	Career Planning
Project-Oriented	- Within the Firm, specify-in-advance the successive project contracts - Establish technical career ladders
Profession-Oriented	- Within the time, specify-in-advance the successive assignments - Establish technical career ladders
Management-Oriented	- Slot into virtually any upward career path - Establish managerial career ladder

2.3.2 Training and Development. Based on the increase in emphasis on productivity and quality, there is an increasing need for continuing education for employees. Evidence exists of a link between training and education and an improvement in productivity. In 1984, the Bureau of National Affairs conducted a study of productivity improvement efforts by U.S. Industries. The study found impressive results in the use of training and education to increase productivity, with 77% of the 195 firms in the study reporting that training programs were "highly effective" or "overall encouraging" (Solomon and LaPorte, 1987:57). Additionally, Solomon and LaPorte (1987) stated that training and education were significant in preserving and enhancing the quality of employee skills.

Continuing education is defined as educational activities engaged in after full-time professional employment has begun and includes courses that update one's knowledge in a current specialty or develops expertise in a new field (Solomon and LaPorte, 1987:57). Additionally, Solomon and LaPorte (1987) proposed that to limit the depth or extent of knowledge of scientific and engineering employees would result in harm to productivity and innovation but may also actually encourage employees to leave.

In addition, training and development is deemed especially necessary in a high-technology organization because technical obsolescence threatens almost all technical specialties. As stated earlier, the pace of technological change can be overwhelming as demonstrated by engineers becoming technically obsolete less than three years after completing an undergraduate engineering program (Solomon and LaPorte, 1987:57). Additionally, Miller (1986) states that professionals respond to continuing education not solely to ward off obsolescence but for personal development reasons as well. These

personal development reasons directly relate back to the characteristics of engineers as previously detailed from the research of Von Glinow (1988).

2.3.3 Career Planning. As organizations provide opportunities for their employees to advance through positions of increasing responsibility, the organization ends up playing a major role in the planning and preparation of these employee moves. An organization's part in career planning is to clearly define job positions, job requirements, job availability, and most of all, possible avenues of career progression.

Therefore, multiple career tracks, which include increased financial and intrinsic reward opportunities, are essential in high-technology firms. These career tracks may include advancement to senior project engineer, major project leadership assignments, or upward managerial promotion. The idea of multiple career tracks relates back to the dual ladder theory reward system as it responds to the differences in employee needs and values.

Organizations must clearly understand the importance of career planning in the early stages of organizational development. High-technology firms, especially, have a large stake in developing innovative human resource practices that thoughtfully attract, motivate, and retain knowledge workers. Career planning is only one of the many human resource practices that can aid in the retention of knowledge workers if well thought out. Therefore, it is necessary to further detail the connection between human resource management and knowledge worker retainability.

2.4 Current Air Force Human Resource Management Practices

2.4.1 Staffing. For the purpose of this research effort, staffing will address one component of employment planning. The estimation of the number of qualified people needed to carry out the organization's mission is modified to address the actual breakdown (number) of job positions, in a civil engineer objective squadron by career orientation, of jobs to be filled by CE company grade officers. The determination of the breakdown of job positions is based on the following definitions of each of the three career orientations addressed in this study.

> *Project Engineer*- more influenced by the intrinsic nature of the task, preference for technically challenging projects, having the freedom to be creative and original.
>
> *Professional Engineer*- is concerned with their professional reputation
>
> *Management Engineer*- preference to work on projects of importance to the organization and on those they see as having a potential for advancement. (Allen and Katz, 1986:188)

The above definitions, slightly modified from the work of Allen and Katz (1986), in combination with the definitions previously given from the research of Lee and Maurer (1997) in Section 2.2, result in the determination of job characteristics for each type of career orientation (Table 2.3). The combination of both sets of definitions of career orientation types, Allen and Katz (1986) and Lee and Maurer (1997) led to a more comprehensive definition of each type. Consequently, project orientation characteristics included: technical, short term involvement and intrinsic reward. Professional orientation job characteristics included: technical, long term and advancement of both the technical body of knowledge and the professional reputation. Management orientation job

characteristics included: non-technical and attached to both the role of a manager and upward mobility in the organization.

Table 2.3 Job Characteristics by Career Orientation

	Project	**Professional**	**Management**
Job Characteristics	- Technical - Short term involvement - Intrinsic rather than extrinsic reward	- Technical - Long term - Advancement of technical body of knowledge - Involves advancement of professional reputation	- Non-technical - Attached to the role of a manager - Attached to upward mobility in the organization

The application of the above job characteristics to CE Company Grade Officer job positions in a CE objective squadron (Appendix A) results in the best-fit categorization of positions by career orientation (Table 2.4). Each Air Force CE CGO job position was categorized into a career orientation with the majority of job positions falling into the management orientation, and the least in the project orientation.

Table 2.4 Categorization of Air Force CE CGO Job Positions by Career Orientation

	Project	Professional	Management
Duty Title	- Program Manager - Project Manager - Programmer	- Mechanical /Electrical Engineer - Architect - Design Engineer - Utility/ Energy Engineer	- Maintenance Engineering Flight Chief or Deputy - Engineering Flight Chief or Deputy - Simplified Acquisition of Base Engineer Requirements (SABER) Chief or Deputy - Environmental Flight Chief or Deputy - Resource Flight Chief or Deputy - Explosive Ordinance Disposal (EOD) Flight Chief - Readiness Flight Chief - Section Commander or Executive Officer

Duty titles that cannot be categorized into one career orientation:

1. general flight member
2. career broadening position

Based on Table 2.4, there is a distinct difference in the job position availability dependent on the engineer career orientation. Therefore, this research intends to show that there is a difference (by career orientation) in the current jobs held by Air Force CE CGOs and the job position availability. Consequently, the null hypothesis below was tested:

> *Hypothesis 2: Among Air Force CE CGOs, there is no difference in their current job and the availability of job positions for each of the three taxonomic types of engineers.*

2.4.2 Training and Development. The specific components of the current HRM practices, targeted for the training and development of CE officers, were determined after a discussion with the Air Force Personnel Center Civil Engineer Task Group. This research led to the identification of three distinct training and development practices that are in place for AF civil engineer officers. The three distinct training and development practices are 1) graduate education, 2) short courses offered at the Civil Engineer and Services School, and 3) conferences/seminars offered by businesses and educational institutes.

Graduate education is available through two Air Force-distinct means, the Air Force Institute of Technology (AFIT) and Air Force tuition assistance. AFIT graduate education can further be broken down into the school programs offered in-residence at AFIT and the Civilian Institution (CI) Program. AFIT in-residence programs offer the opportunity to obtain graduate degrees in several areas of engineering and logistics. Among the curricula offered are Applied Mathematics, Computer Engineering, Engineering and Environmental Management, Meteorology, Operations Research, Contracting Management Program, and Information Systems Management Program.

> AFIT's CI program fills Air Force educational requirements through regular accredited civilian programs when equivalent degree programs are not offered in the resident school. Among the curricula offered are civil engineering, industrial engineering, chemistry, systems technology, information sciences, photographic sciences, meteorology, criminology, and industrial psychology. http://www.afit.af.mil/Schools

Please reference Appendix B for the complete listing of degrees offered by AFIT, in resident and the Civilian Institution Program. The degree that relates specifically to the Civil Engineer career field is the Master of Science in Engineering and Environmental

Management. In this degree program, there is an opportunity to focus on the education sequence of your choice: Human Resource Management, Quantitative Decision Making, Program and Contract Management, Applied Environmental Sciences, and Environmental Systems Analysis and Management (see Appendix C for sequence descriptions).

The Air Force Tuition Assistance (TA) program is the second component of current Air Force HRM practices concerning training and development. Air Force TA provides up to 75% of $250 per semester hour for college courses taken during off duty hours. The Tuition Assistance program does not distinguish between curriculum types and therefore cannot distinguish any differences regarding the different engineer career orientations.

The second component of the current Air Force HRM practices concerning training and development is the short courses offered at the Civil Engineer and Services School (CESS). The mission of the CESS is to develop and deliver civil engineer, environmental, and services professional continuing education in support of U.S. aerospace forces. Among the curricula offered are technical engineering courses, environmental management courses and engineering management courses. The courses offered were not categorized into the three engineer career orientations because there was overlap in the course topics. Because of this overlap, many courses could be placed in all the orientations. Therefore, the only method of clear categorization of the short courses was by their categorization into either technical or non-technical courses. After reviewing each short course description, of those applicable to CE CGOs, the CESS short courses were categorized into technical or non-technical courses, as listed in Table 2.5.

The result of this process was an overwhelming majority of short courses classified as non-technical in nature. For project engineers this could be a significant result if their desire for technical short courses was not being met.

Table 2.5 Categorization of the Civil Engineer and Services School Short Courses (those for which the target audience is CE CGOs) by either technical or non-technical orientation

	Technical	Non-technical
Civil Engineer and Services School Short Courses	- Airfield Pavement Maintenance and Rehabilitation - Airfield Pavement Construction Inspection	- Energy Management Technology - Introduction to the Base Civil Engineer Organization - Readiness Flight Commander's Course - Resources Flight Commander's Course - Engineering Flight Commander's Course - Contracting for Civil Engineering - Project Programming - Simplified Acquisition of Base Engineer Requirements (SABER) Management - Explosive Ordinance Disposal (EOD) Flight Commander's Course - Competitive Sourcing - Housing Privatization - Utilities Privatization - Energy Savings Performance Contract - Environmental Compliance Assessment - Pollution Prevention Program Operations and Management - Introduction to Environmental Management - Unit Environmental Coordinator - Hazardous Material Management Program - Environmental Flight Commander's Course - Environmental Restoration Project Management - Environmental Contracting - Environmental Planning, Programming, and Budgeting - Hazardous Waste Management - Air Quality Management

Other educational opportunities available to Air Force employees are conferences and seminars offered by businesses and educational institutes. Attendance is determined by knowledge requirements and funding availability at the unit level. Depending on the

location and the knowledge requirements, conferences/seminars address a large variety of topics and can not be categorized by career orientation. Instead, this research effort will focus on preference for this type of training and development as a means of differentiating engineers by career orientation. Lee and Maurer (1997) proposed that there were desired training and development practices that will better retain each of the different career orientations. Lee and Maurer (1997) proposed that to better retain project engineers, offer project specific learning; for professional engineers, offer the opportunity to earn a Master of Science (MS) in Engineering or a Joint Master of Science-Master of Business Administration (MBA) Degree; and for management engineers offer the opportunity to earn a MBA or Executive Certificates.

Based on the distinct differences of Air Force HRM practices in the area of training and development, as detailed in the preceding sections, this research effort intends to show that there is a difference (by career orientation) in the desire and opportunity of these HRM practices. Therefore, the null hypothesis below was tested:

> *Hypothesis 3: Among Air Force CE CGOs, there is no difference in the desire and opportunity of Air Force HRM practices in the area of training and development for each of the three taxonomic types of engineers.*

Three distinct areas of Air Force training and development practices have been identified for use in this research: graduate education, CESS Short Courses, and conferences/seminars. Therefore, to properly address these issues Hypothesis #3 has been broken into subsections.

> *Hypothesis 3a: Among Air Force CE CGOs, there is no difference in the desire and opportunity for graduate education for each of the three taxonomic types of engineers.*

Hypothesis 3b: Among Air Force CE CGOs, there is no difference in the desire and opportunity for CESS Short Courses for each of the three taxonomic types of engineers.

Hypothesis 3c: Among Air Force CE CGOs, there is no difference in the desire and opportunity for Conferences/Seminars for each of the three taxonomic types of engineers.

2.4.3 Career Planning. Guidance for the career progression of Civil Engineer Officers is clearly stated in the *Officer Career Path Guide*, published by the Air Force Personnel Center. Included in the Civil Engineer Career Path, Section 5.14 of the Guide, is a Figure of the Civil Engineering Career Path Pyramid (Appendix D) which illustrates the opportunities available at different times in the civil engineer career field. Generally stated the civil engineer officer career progression is one that initially builds depth through technical experience while increasing the job complexity, and personal control and responsibility. After the technical foundation is laid, progression is made to a staff officer position or a career broadening tour. The highest level of career progression is then achieved by a command billet. The *Officer Career Guide* states,

> this narrative does not suggest that all civil engineering officers need to strive to be "the civil engineer" or that there is only one ideal path to that level. However, the path to that level normally includes a strong technical base, squadron command, and a Major Command and Air Staff tour.

Based on the career guidance detailed above, this research effort intends to show that there is a difference (by career orientation) in the perceived limitations regarding career advancement. Therefore, the null hypothesis below was tested:

Hypothesis 4: Among Air Force CE CGOs, there is no difference in perceived limitations regarding engineer career orientations.

2.5 Career Satisfaction

Engineer career orientation theory, especially the Dual Ladder theory, sets out to achieve the goal of providing equivalent career opportunities to engineers. The equivalence of career opportunities, in the form of different career paths, is measured by comparing levels of career satisfaction (Epstein, 1986:33). Note that there are other factors that could affect career satisfaction.

"Career satisfaction encompasses satisfaction with career options" (Epstein, 1986:47). Career satisfaction is included in this study in an effort to compare attitudes and perceptions pertaining to career opportunities within the Air Force. Therefore, given the characteristics of each of the three engineer career orientations and the differences in the current Air Force HRM practices targeting each orientation, it is expected that the level of career satisfaction will be different for Air Force CE CGOs across the career orientations. Consequently, the null hypothesis below was tested:

> *Hypothesis 5: Among Air Force CE CGOs, there is no difference in career satisfaction in the three career orientations of project, professional, and management engineers.*

2.6 Perceived Organizational Support

An additional measure of equivalence in engineer career orientations is the measure of Perceived Organizational Support (POS). "Employees tend to view actions by agents of the organization as actions of the organization itself" (Levinson 1965: 275). Eisenberger, Huntington, Hutchison, and Sowa (1986) furthered that notion by suggesting

> in order to determine the personified organization's readiness to reward increased work effort and to meet needs for praise and approval, employees develop global beliefs concerning the extent to which the organization values their contributionsand cares about their well being (p. 501).

The research findings of Eisenberger et al (1986), by use of a survey method and subsequent factor analysis, indicated that employees do develop the global beliefs described above. Therefore, based on the assumption that POS and its associated global beliefs are applicable to all employees, this research effort will use POS as a measure to help further differentiate the career orientations. Consequently, as differences have been detailed for engineer career orientations, their associated characteristics and the current Air Force HRM practices that target the orientations, this research effort expects that the level of POS will be different across the three engineer orientations. Therefore, the null hypothesis below was tested:

> *Hypothesis 6: Among Air Force CE CGOs, there is no difference in perceived organizational support in the three career orientations of project, professional, and management engineers.*

2.7 Human Resource Management and the Retention of Knowledge Workers

Lee and Maurer (1997) merged their collected theories of voluntary turnover and HRM practices with Allen and Katzs' (1986) theory regarding the career orientation of engineers: project, professional, and management. The combination of these theories resulted in Lee and Maurer's (1997) discussion on how standard HRM practices affect the three types of engineers who follow the decision paths in the unfolding model of voluntary turnover. The research concluded with the determination of how each type of

HRM function facilitates the retention of each type of engineer. The research results were formatted into 4 matrices where the five standard HRM functions were crossed with each type of engineer (Lee and Maurer, 1997:247). For the scope of this thesis, only three of the five HRM practices will be discussed in detail and therefore a revised matrix for which this effort was based is depicted in Table 1.1.

Lee and Maurer have proposed that different approaches in the HRM practices should be taken in an effort to better retain the specified taxonomic type of engineer. Thus, if different career orientations react differently to specific HRM practices, and current AF HRM practices are not consistent with engineer's desires, then there may be a differential change in engineer's initial and current intent to make the Air Force a career, depending on their orientations. Therefore, the null hypothesis below was tested:

> *Hypothesis 7: Among Air Force CE CGOs, there is no difference between the initial and current intent towards a career in the Air Force for the three taxonomic types of engineers.*

2.8 Summary

The literature reviewed in this Chapter addresses engineer career orientation, human resource management and the retention of knowledge workers. This research has applied this combination of theory to Air Force CE CGOs to address the issue of retention. The methodology used in the application is discussed in the next chapter.

III. Methodology

3.1 Survey Justification

Because no data existed that applied the Lee and Maurer (1997) theory to the Air Force, a primary data collection method was used. The data were both objective and perceptual and could have been gathered by a survey or an interview process. Due to the geographic spread of the Air Force CE Officer population, the need for reliable data and the relatively large number of responses desired, a mailed survey was the measurement instrument used. Additional reasons for having chosen the mailed survey are as outlined by Air University (1993:54): 1) primary advantage is a lower cost (in terms of both time and money), 2) better samples available, 3) increased standardization, and 4) ensures greater respondent privacy which allows the respondent to have anonymity.

3.2 Population

All 976 Air Force CE CGOs were selected to participate in this study. Useable mailing addresses were obtained for 927 officers, of which 195 (21.0%) were Second Lieutenants, 164 (17.7%) were First Lieutenants, and 568 (61.3%) were Captains.

3.3 Procedure

Surveys were distributed two ways. First, questionnaires were mailed-out to 863 officers covering all Air Force Major Commands (AF MAJCOMs). Second, 16 CE CGOS in-resident at the Air Force Institute of Technology (Graduate School of Engineering, Engineering and Environmental Management program) and 48 civil engineer officers currently enrolled in the MGT 101, Introduction to the Base Civil

Engineer Organization (Air Force Civil Engineer and Services School) were handed a copy of the survey as they are in the approximate vicinity of this research effort.

Participants in the mail-out survey were sent a survey package that included a cover letter explaining the study, a survey questionnaire, and a return envelope. The 64 participants that were handed a copy of the survey questionnaire were asked to immediately return the questionnaire when completed. The total number of questionnaires handed immediately to the researcher was 64, consequently resulting in a 100% response rate of hand-out surveys. Of the total 863 surveys mailed out, 24 were returned to sender. Therefore, of the remaining 863 mail-out surveys, 443 (52.8%) were completed and returned. One hundred and twenty one (27.3%) were Second Lieutenants, 77 (17.4%) were First Lieutenants, and 245 (55.3%) were Captains. Nineteen percent of the participants were women.

3.4 Measures

The survey questionnaire is an instrument used to extract data from the population under study. Therefore, in the process of survey item development, it is necessary to research theory that would correctly indicate the content domain for measures used in the survey.

> Domain sampling theory states that it is not possible to measure the complete domain of interest, but that it is important that the sample of items drawn from the potential items adequately represents the construct under examination (Ghiselli, Campbell, & Zedeck, 1981)

Once a good understanding of the theory behind each construct was established there were two ways in which to approach the creation of survey items: 1) a deductive approach or 2) an inductive approach (Hinkin, 1998:106).

As established by Hinkin (1998) deductive scale development is identified with a theoretical foundation providing enough information on which to generate an initial set of items. In contrast, Hinkin identifies inductive scale development as being appropriate when the conceptual basis for an item is not easily identifiable. Therefore, inductive scale development results in item generation from the theory foundation in order to develop items to adequately measure the domains of interest.

The application of approaches to this research survey item generation resulted in the distinct categorization of each section of the survey. The research survey section that encompassed the deductive approach is Section 1- Background Information. The other three sections of this research survey were based on inductive scale development: Section 2- Career Outlook, Section 3- Career Planning, and Section 4- Training and Development.

Section 1- Background Information was able to use a deductive approach as the demographic based questions and their format have been refined to the point where there is a "standard" format. The last three sections of the survey, in regards to item development, required the combination of general content theory with the application to a military population. Each section is discussed in further detail below.

3.4.1 Section 1 – Background Information. The information from this section allows a closer inspection of the population according to specific demographic types and aids in determining preferences based on demographic classification. Specifically,

current duty title was obtained by asking the participant to enter their current duty title. These data were used to determine the orientation (e.g. project, professional, management) of current CE CGO job positions. The process of data analysis on the current duty title data began with a reference back to the desired HRM practices in the area of staffing which include progression in the preferred area of work, and realistic previews of both jobs and the employee's possible progression in the organization. The desired HRM practices in the area of staffing are listed in Table 3.1.

Table 3.1 Lee and Maurer (1997) Desired Staffing Practices by Career Orientation

Career Orientation	Staffing
Project-Oriented	- Offer successive and increasingly challenging project contracts - At the firm level, precisely model staffing levels; at the individual level, renegotiate the psychological contract
Profession-Oriented	- Offer successive and increasingly challenging assignments - Offer realistic job previews about the engineer's role within the firm
Management-Oriented	- Offer realistic job previews about managerial opportunities - At the firm level, identify managerial career paths; at the individual level, set realistic expectations about career progression

The characteristics of these desired HRM practices match the job characteristics identified for each career orientation (Table 2.2). Therefore, the categorization of CE CGO job positions into three taxonomic types of engineer career orientations of: 1) project, 2) professional, and 3) management was completed by matching each CE CGO job position to the job characteristics identified (Table 2.2) for each orientation.

Reference Table 3.2 for the categorization of CE CGO job positions by career orientation.

Table 3.2 Categorization of CE Company Grade Officer Job Positions by Career Orientation

	Project	Professional	Management
Duty Title	1. Program manager 2. Project manager 3. Programmer	1. Mechanical/Electrical engineer 2. Architect 3. Design engineer 4. Utility/Energy engineer	1. Maintenance Engineering Flight chief or deputy 2. Engineering Flight chief or deputy 3. Simplified Acquisition of Base Engineer requirements (SABER) chief or deputy 4. Environmental Flight chief or deputy 5. Resource Flight chief or deputy 6. Explosive Ordinance Disposal (EOD) Flight chief 7. Readiness Flight chief 8. Section Commander/Executive Officer

Duty titles that cannot be categorized into one career orientation:

3. General flight member
4. Career Broadening position

To quantify the CE CGO job positions (Table 3.2), the total number of each job position within each career orientation was divided by the total number of job positions (15) for CE CGOs in an objective squadron. This calculation resulted in 20% project-oriented jobs, 26.7% professional oriented jobs, and 53.3% management-oriented jobs and is used only to give a general breakdown of job positions. A second method used to

get a more accurate measure of job types was based on the final survey responses. The survey responses allowed for an actual percentage of job types (of survey respondents) to be calculated. The second calculation was used for any further analysis of job position.

3.4.2 Section 2 – Career Outlook. All questions regarding career orientation, career satisfaction and perceived organizational support were measured using a 7-point Likert scale (1=strongly disagree, 7=strongly agree). The scale determines the level to which individuals agree with statements regarding career preferences.

3.4.2.1 Career Orientation. Previous research on engineer career orientations used a Likert scale to measure career orientation. Allen and Katz (1986) measured career orientation with the questions shown in Table 3.3. Allen and Katz (1986) measured the survey participants degree of career preference for the career orientations of technical, management and project.

Table 3.3 Allen and Katz (1986) Format of Career Orientation Measure

To what extent would you like your career to be:
a) a progression up the technical professional ladder to a higher-level position? b) a progression up the managerial ladder to a higher level position? c) the opportunity to engage in those challenging and exciting research activities and projects with which you are most interested, irrespective of promotion

Allen and Katz, 1986:187

Epstein (1986), citing and modifying the format of Allen and Katz (1986), measured career orientation with the questions shown in Table 3.4. Epstein (1986) measured the survey participants initial preference, initial and current expectations and current job in relation to progression in the technical, management, and project career

orientations.

Table 3.4 Epstein (1986) Format of Career Orientation Measure

The following questions ask about your career. For each question (a,b,c,d) please answer (circle) in each of the three columns using the following key (1=Not at all, 3=Somewhat, 5=To a greater extent)			
	A progression up the a technical career ladder to a higher level position	A progression up a managerial career ladder to a higher level position	A progression of challenging research activities and projects, irrespective of promotion
To what extent:	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
a. would you like your career to be?	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
b. had you expected your career to be?	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
c. do you now expect your career to be?	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5
d. is your career now?	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5

Further development, of the particular measure used in both research efforts (as detailed in Chapter 2), resulted in the combination of the existing measure and a compilation of current research on engineer career orientation. The additional effort was done to refine and introduce items that would best measure this particular item of career orientation.

Therefore, 16 items were formulated to measure career orientation (Table 3.5). The formulation of these items, as stated earlier, was the result of combining current career orientation literature and tested career orientation measures, Allen and Katz (1986), Epstein (1986).

Table 3.5 Sixteen Items Formulated by Researcher to Measure Career Orientation

6a. It is important to me that my technical knowledge remains current.
6b. I want my career to advance to a policy-making position.
6c. I want my career to be attached to the occupation of engineering.
6d. I want my career to be involved with several specific projects.
6e. An important opportunity of the engineering profession is the advancement of technical knowledge.
6f. I want my career to be involved in addressing complex technical problems.
6g. An important opportunity of the engineering profession is the ability to work in several task areas.
6h. I enjoy working on technical problems.
6i. I am not concerned with my career progressing to the management level.
6j. It is important to me that my knowledge of supervisory skills and practices remains current.
6k. An important opportunity of the engineering profession is the advancement of supervisory skills.
6l. I want my career to be attached to my upward mobility in supervision.
6m. It is important to me that I expand my knowledge in areas that are focused on specific tasks.
6n. I want my career to be attached to the role of a manager.
6o. I enjoy working on several diversified tasks.
6p. I enjoy working in a supervisory capacity.

To test the formulated items measuring career orientation further research was conducted and details of this research are in the next section.

3.4.2.1.1 Pilot Survey and Results. Due to the nature of the material discussed in this research effort, it was necessary to conduct a pilot survey (reference Appendix E). The pilot survey aided in the refinement of 16 items, intended to measure career orientation, before the actual survey was conducted. The pilot survey asked each individual to sort each of the 16 items into one of three constructs of career orientation (project, professional, or management) or into a non-matching category.

Thirty-five Air Force CE CGOs completed the pilot survey. Twenty-three (65.7%) were students enrolled at the Air Force Institute of Technology (AFIT) Environmental and Engineering Management (GEEM) program. The remaining 12 (34.3%) were officers in the duty position of Instructor at the AFIT Civil Engineer and Services School. Three (8.6%), 11 (31.4%), and 21 (60.0%) of the participants were Second Lieutenants, First Lieutenants, and Captains respectively. Six percent of the participants were women and 94% were men. The pilot survey resulted in 35 useable responses on which a factor analysis was then conducted.

An important step in analyzing the pilot survey data was to ensure that the participant responses to the items were grouped in the proper categories or constructs. The pilot survey participants were given the definitions of the three engineer career orientations. The participants categorized, based on the given definitions, the 16 items measuring career orientation into the career orientation that indicates the type of engineer that the statement best describes. The categories that the pilot survey participants had to choose from were: project, professional, management and no match. Grouping of the data was done by performing factor analysis. An exploratory factor analysis was performed using the statistical software package SPSS 9.0 for Windows. Reference Table 3.5, of the 16 items tested, items d, g, i, m, and o were intended to measure project orientation. Items a, c, e, f, and h were intended to measure professional orientation. Items b, j, k, l, n, and p were intended to measure management orientation. The results of the factor analysis are shown in Table 3.6. The three factors extracted from this analysis explain 64.3% of the variance and all 16 items factor loaded into their hypothesized constructs.

Table 3.6 Factor Analysis of Pilot Survey Career Orientation Items

Extraction Method: Principle Component Analysis with Promax Rotation N=35

	Project Orientation	Professional Orientation	Management Orientation
ITEM (brief summary)			
D (involved with several specific projects)	**.84**	-.14	-.19
O (working on several diversified tasks)	**.63**		
M (knowledge in areas that are focused on specific tasks)	**.62**	.22	-.22
I (not concerned with my career progressing to the management level)	**.46**	.29	-.35
G (ability to work in several task areas)	**.37**		.35
E (advancement of technical knowledge)	-.18	**.88**	-.28
A (technical knowledge remains current)		**.85**	-.32
F (involved in addressing complex technical problems)	.16	**.77**	-.35
H (enjoy working on technical problems)	.35	**.70**	-.36
C (attached to the occupation of engineering)		**.62**	-.13
J (knowledge of supervisory skills and practices remains current)	-.19	-.36	**.94**
N (career to be attached to the role of a manager)	-.16	-.40	**.93**
P (enjoy working in a supervisory capacity)		-.38	**.92**
K (advancement of supervisory skills)	-.10	-.36	**.91**
L (upward mobility in supervision)	-.13	-.33	**.90**
B (advance to a policy-making position)	-.32	-.15	**.77**
Percent Variance explained by each factor	*12.13*	*14.88*	*37.31*

Note: Bold indicates highest factor loading. Underline indicates hypothesized factor.

The results of the factor analysis grouped the items exactly as anticipated and the aim of the analysis, to obtain the sets of items common to each engineer that could be used to measure individual career orientation, was met. However, each item and any additional comments were reviewed after the factor analysis and modifications were made. Table 3.7 shows modifications made to the pilot survey statements for use then in the final

survey. Items 16c, 16d, 16e, 16f, 16k, 16l, 16n, 16p were not modified. The wording of Items 16a, 16g, 16h, 16i, 16j, 16m, 16o was modified. Additionally, Item 16b, measuring management orientation, was deleted and one item intended to measure professional orientation was added.

Table 3.7 Modifications to Pilot Survey Career Orientation Items

Pilot Survey Statements	Final Survey Statements
6a. It is important to me that my technical knowledge remains current.	a. It is important that my technical knowledge remains current.
6b. I want my career to advance to a policy-making position.	Deleted
6g. An important opportunity of the engineering profession is the ability to work in several task areas.	j. An important opportunity of the engineering profession is the ability to work *on diverse technical tasks*.
6h. I enjoy working on technical problems.	l. I enjoy working on *problems specific to my engineering discipline.*
6i. I am not concerned with my career progressing to the management level.	m. *Moving up in the Air Force is not important to me.*
6j. It is important to me that my knowledge of supervisory skills and practices remains current.	o. It is important that my knowledge of supervisory skills and practices remains current.
6m. It is important to me that I expand my knowledge in areas that are focused on specific tasks.	t. It is important that I expand my knowledge in areas focused on specific tasks.
6o. I enjoy working on several diversified tasks.	w. I enjoy working on *diverse technical tasks.*
Addition	z. I want my career to be attached to upholding engineering norms and ethics.

Note: If an Item 16a-16p is not on this table the item was not modified. Italics indicate wording modifications.

Additionally, a second measure of career orientation was tested by this survey for the first time. The second measure of career orientation involves the individual participating in the survey to 1) read three definitions of engineer career orientations and 2) describe themselves, their current job match and the desired career orientation of their next job

relative to the given engineer career orientations of project engineer, professional engineer, management engineer, or none of the given orientations.

3.4.2.1.2 Final Survey and Results. Analysis of the final survey data, to ensure that the participant responses to the items are grouped in the proper categories/constructs was completed by factor analysis. An exploratory factor analysis was performed using the statistical software package SPSS 10.0 for Windows. The desired outcome would result in the data grouping in the construct for which the measure was intended. Of the 16 items tested to measure career orientation, items d, j, m, t, and w were intended to measure project orientation. Items a, b, e, h, l, and z were intended to measure professional orientation. Items o, q, s, u, and bb were intended to measure management orientation. The results of the factor analysis are shown in Table 3.8. The three factors extracted from this analysis explain 50.5% of the variance. All items hypothesized to measure management and professional orientation loaded on their respective constructs. However, two additional items, Items w and j intended to measure project orientation, loaded on the professional construct.

Table 3.8 Factor Analysis of Final Survey Career Orientation Items

Extraction: Principle Component Analysis with a Varimax Rotation N=404

	Project Orientation	Professional Orientation	Management Orientation
ITEM			
M (moving up in the Air Force is not important to me)	**.43**		-.52
T (knowledge in areas that are focused on specific tasks)	**.76**	.26	.16
D (involved with several specific projects)	**.68**	.29	
L (enjoy problems specific to my engineering discipline)	-.13	**.73**	-.13
B (attached to the occupation of engineering)		**.67**	
H (involved in addressing complex technical problems)	.26	**.67**	-.12
W (enjoy working on diverse technical tasks)	.13	**.66**	
Z (attached to upholding engineering norms and ethics)	.11	**.64**	.14
J (ability to work on diverse technical tasks)	__	**.64**	
A (important that technical knowledge remains current)	.26	**.52**	
E (advancement of technical knowledge)	.39	**.52**	
S (attached to upward mobility in supervision)			**.78**
Q (advancement of supervisory skills)		.11	**.73**
U (attached to role of a manager)		-.20	**.73**
BB (enjoy working in a supervisory capacity)	-.17		**.72**
O (knowledge of supervisory skills remains current)			**.69**
Percent Variance explained by each factor	*10.11*	*21.54*	*18.89*

Note: Bold indicates highest factor loading. Underline indicates hypothesized factor.

The reliability (Cronbachs Alpha) for each construct, as identified in the factor analysis results above of project orientation, professional orientation, and management orientation is 0.39, 0.81, and 0.79 respectively. Cronbachs Alpha represents the correlation between the items in this scale with higher scores indicating higher reliability. The second and third constructs, professional and management orientation, show a strong relationship

among the items in each. However, the first construct of project orientation has resulted in a weak relationship. The weak relationship of the project orientation construct does not allow the statements to measure career orientation in its intended three classifications. Therefore, the second measurement of career orientation (as shown in Item 10 of the survey) is used for classification of the survey respondents into the engineer career orientations.

3.4.2.2 Career Satisfaction and Perceived Organizational Support. Epstein (1986), in the development of career satisfaction measures for her own study, used a factor-analytic approach as applied to a tested 1977 Quality of Employment Survey. The result of the factor analysis was a 3-item measure of career satisfaction. The 3-item measure, with the modification of the words Air Force substituted in for the word company, is used to measure career satisfaction in this study (Table 3.9).

Table 3.9 Final Survey Career Satisfaction Items

For each statement, please fill in the circle for the number that indicates the extent to which you agree the statement is true. Use the scale: 1- strongly disagree, 2- moderately disagree, 3- slightly disagree, 4- neither disagree or agree, 5- slightly agree, 6- moderately agree, 7- strongly agree
a. The opportunities for advancement in the Air Force are suited to my personal career goals.
b. In general, I am satisfied with my career.
c. My skills and abilities are well-suited to my career choice.

The findings of Eisenberger et al (1986) proposed that employees' commitment to an organization is strongly influenced by their perception of the organization's commitment to them. "Perceived organizational support is assumed to increase the employee's affective attachment to the organization and his or her expectancy that a

greater effort toward meeting organizational goals will be rewarded" (Eisenberger et al, 1986:500). Therefore, it was necessary for this research effort to include a measurement of perceived organizational support. Eisenberger , Fasolo, and Davis-LaMastro (1990) refined the initial thirty-six item measure of perceived organizational support to nine items. Using a factor-analytic approach resulted in use of top nine items with the highest factor loading (Table 3.10). Eisenberger, Fasolo, and Davis-LaMastro (1990) used statements regarding employee perceptions of their organization and its attitudes towards employees to measure POS.

Table 3.10 Final Survey Perceived Organizational Support Items

The organization strongly considers my goals and values.
Help is available from the organization when I have a problem.
The organization takes pride in my accomplishments at work.
The organization really cares about my well-being.
The organization is willing to extend itself in order to help me perform my job to the best of my ability.
Even if I did the best job possible, the organization would fail to notice.
The organization cares about my general satisfaction at work.
The organization shows very little concern for me.
The organization cares about my opinions.

These identified nine items, exactly as worded except with the modification of Air Force substituted in for the word organization, were used as the measure of perceived organizational support.

Analysis of the final survey data, to ensure that the participant responses to the items are grouped in the proper categories/constructs, was completed by factor analysis. An exploratory factor analysis was performed using the statistical software package SPSS

10.0 for Windows. The desired outcome would result in the data grouping into two constructs, career satisfaction and perceived organizational support, for which the measure was intended. The results of the factor analysis are shown in Table 3.11.

Table 3.11 Principle Component Factor Analysis of Final Survey Career Satisfaction and Perceived Organizational Support Items Using Varimax Rotation

N=404

Career Satisfaction Items and Perceived Organizational Support (from ITEM #12)	**Perceived Organizational Support**	**Career Satisfaction**
c. The Air Force strongly considers my goals and values.	**.63**	.30
f. Help is available from the Air Force when I have a problem.	**.64**	.15
i. The Air Force takes pride in my accomplishments at work.	**.69**	.21
k. The Air Force really cares about my well-being.	**.76**	.22
n. The Air Force is willing to extend itself in order to help me perform my job to the best of my ability.	**.69**	.16
r. Even if I did the best job possible, the Air Force would fail to notice.	**.66**	-.01
v. The Air Force cares about my general satisfaction at work.	**.72**	.34
y. The Air Force shows very little concern for me.	**.72**	.22
aa. The Air Force cares about my opinions.	**.73**	.19
g. The opportunities for advancement in the Air Force are well suited to my personal goals.	.45	**.59**
p. In general, I am satisfied with my career.	.41	**.69**
x. My skills and abilities are well suited for my career choice	-.01	**.83**

Note: Bold indicates highest factor loading. Underline indicates hypothesized factor.

The reliability (Cronbachs Alpha) for the items measuring Career Satisfaction was 0.65. A guideline often used is the requirement of alpha to be 0.70 or above (Nunnally, 1978). Therefore, if Item X is deleted from the three items measuring career satisfaction, the alpha increases to 0.74 and thus results in a stronger relationship. Consequently, only 2 of the 3 items (Items g and p) were used then to measure Career Satisfaction.

The reliability (Cronbachs Alpha) for the construct measuring POS is 0.88. Therefore, the items used to measure POS have a strong relationship. Consequently, all 9 items were used then to determine the level of POS.

3.4.2.3 Career Intent. Career intent, both current and initial, was measured using a five-point scale. The career intent measure was developed by the researcher and the scale measured the survey participant's intention toward making the Air Force a career at the time upon entering active duty and their current intentions toward remaining in the Air Force. The scale for initial intent ranged from 1= definitely intended to remain to 5 = definitely intended to separate. The scale for current intent ranged from 1= definitely remain to 5 = definitely separate.

3.4.3 Section 3 – Career Planning. In the third section of the survey questionnaire, individuals are questioned as to the level to which they agree or disagree with statements regarding career planning. These questions were formulated in an effort to measure the individual's perception of Air Force career progression. The statements ask the individual if their career progression is prohibited, and if so, in which engineer career orientation is this evident. In the last question of this section, individuals are questioned as to the level to which they agree or disagree with statement regarding their career guidance.

3.4.4 Section 4 – Training and Development. In the last section of the survey individuals are questioned as to the level to which they agree or disagree with statements regarding training and development. The questions target the individual's perception of their educational opportunities, availability and requirements. The questions in this section were determined after a phone conversation with the Air Force Personnel Center

Civil Engineer Task Group. The phone conversation led to the identification of three distinct training and development practices that are in place for AF civil engineer officers. The three distinct training and development practices are 1) graduate education, 2) short courses offered at the Civil Engineer and Services School, and 3) conferences/seminars offered by businesses and educational institutes. Therefore, the questions in this section target the individual's perception of their educational opportunities, availability and requirements in reference to the three identified training and development practices.

3.5 Analyses Conducted

In this section, each test used for analysis is discussed.

3.5.1 Comparison Tests. The test for significance of difference between two proportions (Bruning and Kintz, 1968:199) was used to test differences in career orientation, a logically dichotomous variable. Career Orientation is dichotomous in that a survey participant was either oriented or not oriented in one of three career orientations.

A paired-samples t test was used to compare the means of opportunity and desire responses for identified HRM practices within each career orientation.

A oneway analysis of variance (ANOVA) was used to test the null hypothesis that several group means are equal in the population. The ANOVA test was specifically used to test for significant differences among the survey responses given across all career orientations. Bonferonni post-hoc tests were conducted to determine where the significant differences occurred.

3.5.2 Regression. Hierarchical regression was used to estimate the coefficients of a linear equation, involving several independent variables, that best predicts the value of the dependent variable. The dependent variable in this research was current career intent. Regression was used to determine the effect on current intent of all variables previously discussed: rank, staffing, career orientation, graduate education, CESS short courses, conferences/seminars, career planning, career satisfaction, and perceived organizational support. In addition, gender was entered as a control variable in the model. Change in career orientation was added to include the difference between a participant's career orientation and their career orientation preference for their next job in the model. For use in the regression, each variable received a distinct definition. The definitions for each variable are listed in Table 3.12.

Table 3.12 Definition of Variables used in Linear Regression

Variable	Definition for use in Linear Regression
Career Intent	Survey response to Item 8 (1=definitely remain, 5=definitely separate)
Gender	Survey responses to Item 1 (0=male, 1=female)
Staffing	Formula: |Career Orientation *(Item 10)* – Current Job Orientation (*Item 3)*|
Career Orientation (Project Dummy and Professional Dummy)	Survey responses to Item 10 (1=Project, 2=Professional, 3=Management) Dummy variables are used for comparison against a management baseline
Change in Career Orientation	Formula: |Career Orientation *(Item 10)* – Career Orientation preference for next job (*Item 12)*|
Graduate Education	Formula: Opportunity – Desire for graduate education Note: different for each orientation- based on the career orientation and its associated "desired" graduate education
Civil Engineer and Services School (CESS) Short Courses	Formula: Opportunity – Desire for CESS short courses Note: different for each orientation- based on the career orientation and its associated "desired" short courses
Conferences/Seminars	Formula: Opportunity – Desire for conferences/seminars Note: different for each orientation- based on the career orientation and its associated "desired" conferences/seminars
Career Planning	Survey responses to Item 13a (The Air Force allows me to progress in the career orientation of my choice; 1=strongly disagree to 7=strongly agree)
Career Satisfaction	Average of survey responses to career satisfaction items
Perceived Organizational Support	Average of survey responses to perceived organizational support items

IV. Results

4.1 Overview

This Chapter will address the results of the survey. Progressing through each of the research hypothesis, as stated in Chapter 2, the related survey results are discussed in the appropriate sections. As retention is the issue ultimately addressed by this research, Table 4.1 is a descriptive table of variables with current career intent as the dependent variable. Reference Table 3.12 for detailed definitions of all variables.

Table 4.1 Descriptive Statistics- Lieutenant

Variables	M (SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Current Intent	3.26 (1.03)											
2. Gender	.25 (.43)	.30**										
3. Staffing	.81 (.78)	.03	.09									
4. Project Career Orientation	.50 (.50)	.06	.01	.11								
5. Professional Career Orientation	.17 (.38)	.05	-.01	-.03	-.45**							
6. Graduate Education	-1.45 (2.65)	.01	.04	-.00	.00	-.13*						
7. Civil Engineer and Services School Short Courses	-.98 (2.27)	.09	-.03	-.13*	.07	-.10	.30**					
8. Conferences/ Seminars	-1.69 (3.03)	-.08	-.10	-.14*	.12	-.16*	.28**	.36**				
9. Career Planning	3.42 (1.51)	-.27**	-.14*	-.03	-.06	-.06	.07	.01	.11			
10. Career Satisfaction	4.45 (1.33)	-.54**	-.28**	-.15*	-.17*	-.07	.14*	.02	.18*	.49**	(.63)	
11. Perceived Organizational Support	4.39 (1.01)	-.24**	-.18*	-.07	.05	-.07	.15*	.13*	.24**	.46**	.60**	(.89)

*p<.05 **p<.001 N=173 Note: reliability shown on the diagonal, where applicable

Table 4.2 Descriptive Statistics- Captain

Variables	M (SD)	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Current Intent	2.61 (1.25)											
2. Gender	.14 (.35)	.10										
3. Staffing	.81 (.92)	.10	.08									
4. Project Career Orientation	.27 (.44)	.19**	.10	.39**								
5. Professional Career Orientation	.10 (.31)	.04	-.05	.04	-.20**							
6. Graduate Education	-.82 (2.55)	-.22**	.02	-.15*	-.15*	.05						
7. Civil Engineer and Services School Short Courses	-1.10 (2.39)	.03	-.05	-.04	.01	-.05	.22**					
8. Conferences/ Seminars	-2.06 (1.95)	-.10	-.10	-.08	.08	-.02	.20**	.51**				
9. Career Planning	4.03 (1.69)	-.37**	-.10	-.28**	-.27**	-.04	.23**	.15*	.19*			
10. Career Satisfaction	4.83 (1.41)	-.67**	-.02	-.10	-.14*	-.06	.27**	.06	.20**	.48**	(.81)	
11. Perceived Organizational Support *(.88)*	4.43 (.98)	-.39**	.02	-.09	-.14*	-.02	.27**	.18*	.29**	.45**	.61**	(.88)

*p<.05 **p<.001 N=231 Note: reliability shown on the diagonal, where applicable

4.2 Career Orientation

Hypothesis 1: In the application of Allen and Katz's (1986) three taxonomic engineer types to Air Force CE CGOs, there is no difference in career orientations in Air Force CE CGOs.

To determine if the typology held with the Air Force CE CGOs, respondents read a description of each type of engineer career orientations project, professional, and management and indicated which type best described their orientation. Respondents also had the option of choosing "none of the above". The results are summarized in Table 4.3. Thirty-nine of the total 443 survey participants did not categorize themselves into one of the career orientations; therefore, their responses were deleted from the analysis. Of the 404 remaining survey participants, 50% indicated they were management oriented, 36.9% project oriented and 13.1% professional oriented. The test for significance of difference between two proportions (Bruning and Kintz, 1968) was used to determine if significant differences existed in the orientations listed in Table 4.3, and whether the change from Lieutenant to Captain is significant for each career orientation in Table 4.4.

Table 4.3 Comparisons of Air Force CE CGO Career Orientations Using Difference of Proportions Tests

Career Orientation	Percentage of AF CE CGOs (as determined by the final survey)	Project (Z-Value)	Professional (Z-value)
Project (N=149)	**36.9%**		
Professional (N=53)	**13.1%**	**5.75****	
Management (N=202)	**50.0%**	**3.53****	**9.77****

**p<.001 N=404

The results indicate that there is a significant difference in career orientation proportions. Thus Hypothesis #1 is rejected, and different orientations of CE CGOs do exist in the Air Force. Further analysis, the breakdown of survey responses by Lieutenant and Captain responses (Tables 4.4) indicate that there is a significant difference in the shift in engineer career orientations from Lieutenants to Captains. The most significant shifts occurred from project (decrease of 24%, Z=7.07, p<.001) and management (increase of 30%, Z=8.92, p<.001) CE CGOs.

Table 4.4 Air Force CE CGO Career Orientation Results of Difference of Proportion Tests between Lieutenants and Captains

Career Orientation	Percentage of AF CE Lieutenants	Percentage of AF CE Captains	Test of Proportion Z value
Project (N=149)	**50.3%**	**26.8%**	**-7.07****
Professional (N=53)	**16.8%**	**10.4%**	**-2.67***
Management (N=202)	**32.9%**	**62.8%**	**8.92****
Total number (percent of respondents)	**173 (42.8%)**	**231(57.2%)**	

*p<.05 **p<.001

4.3 Staffing

Hypothesis 2: Among Air Force CE CGOs, there is no difference in their current job type and the availability of job positions for each of the three taxonomic types of engineers.

To address this hypothesis CE CGO job types were categorized and compared with their career orientations project, professional, or management. In Table 4.5 the results of the comparison, between percentages of job types by career orientation and individual's career orientation resulted in 31% project, 15% professional and 54% management jobs. No significant differences were found when comparing these percentages to the respondents' actual career orientations.

Table 4.5 Comparison of Job Positions with Career Orientation Of CE CGOs and Significance Test Results

Career Orientations	Categorization of CE CGO Job Positions by Type (from Survey responses) N=404	Breakdown of CE CGOs By Career Orientation (from Survey responses) N=404	Test of Proportion Z Value
Project	**31.0%**	**36.9%**	**-1.77**
Professional	**15.0%**	**13.1%**	**.78**
Management	**54.0%**	**50.0%**	**1.14**

This Hypothesis is further explored by the more detailed breakdown of AF CGOs into Lieutenants and Captains. No significant differences were found in the Lieutenant sample between job position and career orientation (Table 4.6). However, at the Captain level, significant differences were found in the comparison of professional and management jobs and orientation (Table 4.7). The results indicate that the Air Force has too many professional and not enough management jobs to meet the orientation of its engineers.

Table 4.6 Comparison of Job Positions and Career Orientation of CE Lieutenants

Career Orientations	Categorization of CE Lieutenant Job Positions by Type (from Survey responses) N=173	Breakdown of CE Lieutenants By Career Orientation (from Survey responses) N=173	Test of Proportion Z Value
Project	**48.0%**	**50.3%**	**-.65**
Professional	**13.3%**	**16.8 %**	**-1.39**
Management	**38.7%**	**32.9 %**	**1.72**

Table 4.7 Comparison of Job Positions and Career Orientation Of CE Captains

Career Orientations	Categorization of CE Captain Job Positions by Type (from Survey responses) N=231	Breakdown of CE Captains By Career Orientation (from Survey responses) N=231	Test of Proportion Z Value
Project	**28.6%**	**26.8%**	**.57**
Professional	**1.3%**	**10.4 %**	**5.62****
Management	**70.1%**	**62.8 %**	**-2.20***

*p<.05 ** p<.01

4.4 Training and Development

Hypothesis 3: Among Air Force CE CGOs, there is no difference in the desire and opportunity of Air Force HRM practices in the area of training and development for each of the three taxonomic types of engineers.

The three AF-distinct training and development practices provided for civil engineers are 1) graduate education, 2) short courses offered at the Civil Engineer and Services School, and 3) conferences/seminars offered by businesses and educational institutes. The desired training and development practices according to Lee and Maurer (1997) are identified in Table 4.8. The comparison between the desired HRM practices and the opportunity for each of these practices was done for each career orientation.

Table 4.8 Lee and Maurer (1997) Desired Training and Development Practices by Career Orientation

Career Orientation	Training and Development
Project-Oriented	- Offer Project-Specific Learning - Negotiate an individual learning package
Profession-Oriented	- Offer Opportunity to earn an MS in Engineering or Joint MS-MBA Degree
Management-Oriented	- Offer Opportunity to Earn an MBA, EMBA, or Executive Certificate

4.4.1 Graduate Education.

Hypothesis 3a: Among Air Force CE CGOs, there is no difference in the desire and opportunity for graduate education for each of the three taxonomic types of engineers.

The results of survey responses regarding graduate education items are in Table 4.9.

Table 4.9 Comparison of Survey Response Means (Regarding Graduate Education) by Engineer Career Orientation using a Oneway ANOVA

ITEM 14 (letter indicates how presented in survey)	Project Response Mean (N=149)	Professional Response Mean (N=53)	Management Response Mean (N=202)	Comparison across orientations
a. The Air Force allows me ample opportunity to pursue a technical Masters Degree.	4.09	4.47	4.29	.86
b. The Air Force allows me ample opportunity to pursue a business Masters Degree.	4.65	4.55	4.25	2.56
i. I wish to have a technical Masters Degree.	5.54	5.87	4.80	11.66**
j. I wish to have a business Masters Degree.	4.14	4.19	4.99	10.34 **

**p<.01

A oneway ANOVA was used to determine significance across the three career orientations in response to the graduate education survey response means in Table 4.9. Significant differences, across career orientations, were found in the desire to have technical and business Master Degrees. The Bonferroni multiple comparison test was used to pinpoint why the overall AVOVA test was significant for those who desired a technical or business Masters' degree. The Bonferroni test indicated management orientation responses were significantly different from both project and professional orientation responses.

A paired-sample t test was used to compare the means of the variables, the desire and opportunity for each type of degree for each career orientation as well as the desire to have either type of graduate degree, from Table 4.9. The results of the paired sample t test are given in Table 4.10.

Table 4.10 Significance between Survey Responses on Graduate Education by Career Orientation

SURVEY ITEMS COMPARED	Project Orientation (N=149)	Professional Orientation (N=53)	Management Orientation (N=202)
a. The Air Force allows me ample opportunity to pursue a technical Masters Degree.	**4.09**	**4.47**	**4.29**
and			
i. I wish to have a technical Masters Degree.	**5.54**	**5.87**	**4.80**
T-Test Value	**-6.81*** **	**-3.94*** **	**-2.67****
b. The Air Force allows me ample opportunity to pursue a business Masters Degree.	**4.65**	**4.55**	**4.25**
and			
j. I wish to have a business Masters Degree.	**4.14**	**4.19**	**4.99**
T-Test Value	**2.55****	**1.01**	**-4.16****
i. I wish to have a technical Masters Degree.	**5.54**	**5.87**	**4.80**
and			
j. I wish to have a business Masters Degree.	**4.14**	**4.19**	**4.99**
T-Test Value	**6.09*** **	**4.90*** **	**-.94**

**p<.01 ***p<.001

The findings indicate that across all three career orientations a difference in the desire and opportunity to have a technical Masters Degree exists. Two of the career orientations, project and management, show a difference in the desire and opportunity to have a business Masters Degree. Additionally, project and professional orientations show a significant difference in the desire to obtain a technical versus a business Masters Degree therefore, Hypothesis 3a was rejected.

4.4.2 Civil Engineer and Services School (CESS) Short Courses.

Hypothesis 3b: Among Air Force CE CGOs, there is no difference in the desire and opportunity for CESS short courses for each of the three taxonomic types of engineers.

The results of survey responses regarding CESS Short Course items are in Table 4.11. Additionally, a oneway ANOVA was used to determine significance across all three orientations regarding responses to Short Course survey items. The results of the oneway ANOVA are also shown in Table 4.11. The results show that no significant difference between orientation in the opportunity to take short courses ($F=.31$, $p>.05$) However, significant differences, across career orientations, were found in the desire to take management and project-specific short courses ($F=5.45$, $p<.05$ and $F=5.05$, $p<.05$ respectively). The Bonferroni multiple comparison test was used to pinpoint why there was a significant difference for the desire to take management or project-specific short courses. The Bonferroni test indicated that management orientation responses were significantly different from professional orientation responses but not from project orientation responses.

Table 4.11 Comparison of Survey Response Means (Regarding CESS Short Courses) by Engineer Career Orientation Using A One way ANOVA

ITEM 14	Project Response Mean	Professional Response Mean	Management Response Mean	Comparison across orientations
c. The Air Force allows me ample opportunity to take short courses at the Civil Engineer and Services School.	4.39	4.23	4.26	.31
k. I would like to take management short courses at the Civil Engineer and Services School.	4.77	4.74	5.29	5.45**
l. I would like to take project-specific short courses at the Civil Engineer and Services School.	5.31	5.42	4.88	5.05**
m. I would like to take profession oriented short courses at the Civil Engineer and Services School.	5.30	5.70	5.32	1.92

N= 404 **p<.01

A paired-sample t test was used to compare the means of the variables, the desire and opportunity to take short courses by career orientation, from Table 4.11. The results of the paired sample t test are given in Table 4.12.

Table 4.12 Significance between Survey Responses on CESS Short Courses by Career Orientation

SURVEY ITEMS COMPARED	Project Orientation (N=149)	Professional Orientation (N=53)	Management Orientation (N=202)
c. The Air Force allows me ample opportunity to take short courses at the Civil Engineer and Services School.	**4.39**	**4.23**	**4.26**
and			
l. I would like to take project-specific short courses at the Civil Engineer and Services School.	**5.31**	**5.42**	**4.88**
T Test Value	**-4.82*** **	**-3.48*** **	**-3.69*** **
c. The Air Force allows me ample opportunity to take short courses at the Civil Engineer and Services School.	**4.39**	**4.23**	**4.26**
and			
m. I would like to take profession oriented short courses at the Civil Engineer and Services School.	**5.30**	**5.70**	**5.32**
T Test Value	**-4.91*** **	**-4.32*** **	**-6.66*** **
c. The Air Force allows me ample opportunity to take short courses at the Civil Engineer and Services School.	**4.39**	**4.23**	**4.26**
and			
k. I would like to take management short courses at the Civil Engineer and Services School.	**4.77**	**4.74**	**5.29**
T Test Value	**-1.89***	**-1.36**	**-6.40*** **

*p<.05 ***p<.001

The findings indicate that across all three career orientations there is a perceived difference between the opportunity and desire to take any type of short course at the Civil Engineer and Services School therefore, Hypothesis 3b was rejected.

4.4.3 Conferences/Seminars.

Hypothesis 3c: Among Air Force CE CGOs, there is no difference in the desire and opportunity for conferences/seminars for each of the three taxonomic types of engineers.

The results of survey responses regarding Conferences/Seminars items are in Table 4.13. A oneway ANOVA was used to determine significance across all three orientations regarding responses to Conference/Seminar survey items. The results of the oneway ANOVA are shown in Table 4.13. Significant differences, across career orientations, were found in the opportunity to attend management conferences/seminars and in the desire to attend all three types of conferences/seminars (project, professional, and management). A Bonferroni test indicated management orientation responses were significantly different from project orientation responses but not significantly different from professional orientation responses for desire of any type of course.

Table 4.13 Comparison of Survey Response Means (Regarding Conference/Seminar) by Engineer Career Orientation Using Oneway ANOVA

ITEM 14	Project Response Mean	Professional Response Mean	Management Response Mean	Comparison across orientations
d. The Air Force allows me ample opportunity to attend management conferences/seminars offered by businesses and educational institutes.	4.06	3.92	3.63	3.18*
e. The Air Force allows me ample opportunity to attend technical conferences/seminars that are oriented towards expanding my engineering knowledge base.	4.08	3.81	3.79	1.48
f. The Air Force allows me ample opportunity to attend conferences/seminars that are oriented towards expanding my knowledge regarding a specific project.	4.20	3.74	3.88	1.40
n. I would like to attend management conferences/seminars offered by businesses and educational institutes.	5.28	5.42	5.65	3.31*
o. I would like to attend technical conferences/seminars that are oriented towards expanding my engineering knowledge base.	6.05	6.28	5.59	15.06**
p. I would like to attend conferences/seminars that are oriented towards expanding my knowledge regarding a specific project.	5.74	5.77	5.20	11.04**

N=404 *p<.05 **p<.01

A paired-sample t-test was used to compare the means of the variables displayed above.

The results of the paired sample t-test are given in Table 4.14.

Table 4.14 Significance between Survey Responses on Conferences/Seminars by Career Orientation

SURVEY ITEMS COMPARED	Project Orientation (N=149)	Professional Orientation (N=53)	Management Orientation (N=202)
f. The Air Force allows me ample opportunity to attend conferences/seminars that are oriented towards expanding my knowledge regarding a specific project.	**4.20**	**3.74**	**3.88**
and			
p. I would like to attend conferences/seminars that are oriented towards expanding my knowledge regarding a specific project.	**5.74**	**5.77**	**5.20**
T Test Value	**-6.10*** **	**-7.68*** **	**-9.93*** **
e. The Air Force allows me ample opportunity to attend technical conferences/seminars that are oriented towards expanding my engineering knowledge base.	**4.08**	**3.81**	**3.79**
and			
o. I would like to attend technical conferences/seminars that are oriented towards expanding my engineering knowledge base.	**6.05**	**6.28**	**5.59**
T Test Value	**-12.90*** **	**-8.97*** **	**-12.99*** **
d. The Air Force allows me ample opportunity to attend management conferences/seminars offered by businesses and educational institutes.	**4.06**	**3.92**	**3.63**
and			
n. I would like to attend management conferences/seminars offered by businesses and educational institutes.	**5.28**	**5.42**	**5.65**
T Test Value	**-6.91*** **	**-4.46*** **	**-14.42*** **

***p<.001

The findings indicated large differences, in all career orientations, in the opportunity and desire for all three types of conferences/seminars (project, professional, and management) therefore, Hypothesis 3c was rejected.

4.5 Career Planning

Hypothesis 4: Among Air Force CE CGOs, there is no difference in perceived limitations regarding engineer career orientations.

The results of survey responses regarding Career Planning items are in Table 4.15. The survey responses indicate that all orientations feel they are most limited to a career that is management oriented. A oneway ANOVA was used to compare the means of the variables across the career orientations. The results of the oneway ANOVA are given in Table 4.15. A significant difference in response was apparent regarding the ability to progress in the career orientation of choice; therefore, Hypothesis 4 was rejected. The Bonferroni multiple comparison test was used to pinpoint why there was a significant difference in opportunity for career progression in the Air Force. The Bonferroni test result indicated management orientation responses are significantly different from both project and professional orientation responses. The finding of significant difference for opportunity for career progression is further substantiated by Air Force CE Captains but not by Lieutenants. The results of this further analysis are seen in Tables 4.16 and 4.17.

Table 4.15 Comparison of Survey Responses (Regarding Career Planning) by Engineer Career Orientation Using a Oneway ANOVA

ITEM 13	Project Response Mean (N=149)	Professional Response Mean (N=53)	Management Response Mean (N=202)	F Value
a. The Air Force allows me to progress in the career orientation of my choice.	3.30	3.51	4.18	14.13**
b. The Air Force limits me to a career that is project-orientated.	3.09	2.89	2.99	.48
c. The Air Force limits me to a career that is profession-oriented.	3.03	3.06	3.12	.20
d. The Air Force limits me to a career that is management-oriented.	5.01	5.00	4.90	.27

**p<.01

Table 4.16 Significance between Career Orientation Groups Regarding Lieutenant Survey Responses on Career Planning Using a Oneway ANOVA

ITEM 13	Project Response Mean	Professional Response Mean	Management Response Mean	F Value
a. The Air Force allows me to progress in the career orientation of my choice.	3.31	3.24	3.65	1.12
b. The Air Force limits me to a career that is project-orientated.	3.14	2.93	3.44	1.36
c. The Air Force limits me to a career that is profession-oriented.	3.10	2.83	3.28	1.34
d. The Air Force limits me to a career that is management-oriented.	5.10	5.34	4.84	1.23

N= 173

No significant differences were found among career orientations in regards to Lieutenant responses to career planning items.

Table 4.17 Significance between Career Orientation Groups Regarding Captain Survey Responses on Career Planning Using a Oneway ANOVA

ITEM 13	Project Response Mean	Professional Response Mean	Management Response Mean	F Value
a. The Air Force allows me to progress in the career orientation of my choice.	3.27	3.83	4.39	11.01**
b. The Air Force limits me to a career that is project-orientated.	3.03	2.83	2.81	.59
c. The Air Force limits me to a career that is profession-oriented.	2.94	3.33	3.06	.78
d. The Air Force limits me to a career that is management-oriented.	4.87	4.58	4.92	.50

**p<.01 N=231

The Bonferroni test showed a significant difference between management orientation responses and project orientation responses but not professional orientation responses.

4.6 Career Satisfaction

Hypothesis 5: Among Air Force CE CGOs, there is no difference in career satisfaction in the three career orientations of project, professional, and management engineers.

The results of the survey responses for career satisfaction are shown in Table 4.18. The results indicated that the management orientation had the highest level of career satisfaction.

Table 4.18 Survey Response Means for Career Satisfaction by Career Orientation

Career Satisfaction measures from ITEM 12	Project	Professional	Management	F Value
All CGOsCareer Satisfaction Response Mean	4.33 (N=149)	4.38 (N=53)	4.98 (N=202)	11.24***
Lieutenant Career Satisfaction Response Mean	4.21 (N=87)	4.69 (N=29)	4.90 (N=57)	5.35**
Captain Career Satisfaction Response Mean	4.50 (N=62)	4.90 (N=24)	5.01 (N=145)	3.42*

***p<.001

The results show significant differences in career satisfaction across the three orientations, as determined by a oneway ANOVA ($F=11.24$, $p< .001$); therefore, Hypothesis 5 was rejected. A Bonferroni multiple comparison test showed management orientation responses were significantly different from both the project and professional orientation responses. The significant differences were further substantiated by the breakdown of responses by Lieutenants and Captains. Lieutenant survey responses means for career satisfaction result in significant differences across career orientation as determined by a oneway ANOVA Test ($F=5.35$, $p<.01$). The Bonferroni test showed that management orientation responses were significantly different from the project orientation responses but not the professional orientation responses. Captain survey responses means for career satisfaction result in significant differences across career orientation as determined by a oneway ANOVA Test ($F=3.42$, $p<.05$). The Bonferroni test showed that management orientation responses were significantly different from the project orientation responses but not the professional orientation responses.

4.7 Perceived Organizational Support

Hypothesis 6: Among Air Force CE CGOs, there is no difference in perceived organizational support in the three career orientations of project, professional, and management engineers.

The results of the survey responses for perceived organizational support are shown in Table 4.19.

Table 4.19 Survey Response Means for Perceived Organizational Support by Career Orientation

POS items in Survey Question #12	Project	Professional	Management	F Value
All CGOs POS Response Mean	4.34 (N=149)	4.29 (N=53)	4.49 (N=202)	1.48
Lieutenant POS Response Mean	4.44 (N=87)	4.23 (N=29)	4.39 (N=57)	0.45
Captain POS Response Mean	4.21 (N=62)	4.36 (N=24)	4.53 (N=145)	2.54

The finding on survey responses means (by career orientation) for POS, as determined by a oneway Anova Test was not significant; therefore, Hypothesis 6 was not rejected. The finding of no significant differences is further substantiated by the breakdown of responses by Lieutenants and Captains. Lieutenant survey responses means for POS show no significant difference across career orientation as determined by a oneway ANOVA. Additionally, Captain survey responses means for POS, show no significant difference across career orientation as determined by a oneway ANOVA.

4.8 Career Intent

Hypothesis 7: Among Air Force CE CGOs, there is no difference between the initial and current intent towards a career in the Air Force for the three taxonomic types of engineers.

The results of the survey responses for career intent are shown in Table 4.20. Additionally, the results of a paired-sample t test comparing the two statement responses within each career orientation is included in Table 4.20. Significant differences in current and initial intent were apparent in the project and professional career orientations; therefore, Hypothesis 7 was rejected.

Table 4.20 Comparison of Survey Responses (Career Intent) by Career Orientation

ITEMS 8 AND 9	Project Response Mean (N=149)	Professional Response Mean (N=53)	Management Response Mean (N=202)	F Value (determined by oneway ANOVA)
Initial (at time of coming active duty) Intention toward making the Air Force a career.	**2.84**	**2.57**	**2.53**	**3.15***
Current Intention toward remaining in the Air Force.	**3.19**	**3.01**	**2.61**	**11.24****
T value for comparison of Initial and Current Intent	*-3.167****	*-2.286**	*-.773*	

*p<.05 **p<.01 ***p<.001

Additionally, a oneway ANOVA compared the differences across the three career orientations in response to the career intent survey items. Significant differences, across all three career orientations, were found in current and initial career intent. The Bonferroni test indicated for initial intent, management orientation responses were

significantly different than project orientation responses; for current intent, management orientation responses were significantly different than both project and professional orientation responses.

Additional analysis, accomplished by a breakdown of CGOs into Lieutenants and Captains further details these general findings. The further analysis is below. Significant differences in current and initial intent were apparent in all three career orientations.

Table 4.21 Comparison of Lieutenant Survey Responses for Career Intent (by Career Orientation)

ITEMS 8 and 9	Project Response Mean (N=87)	Professional Response Mean (N=29)	Management Response Mean (N=57)	F Value (determined by oneway ANOVA)
Initial (at time of coming active duty) Intention toward making the Air Force a career.	3.11	2.66	2.65	4.38*
Current Intention toward remaining in the Air Force.	3.33	3.38	3.11	1.01
T value for comparison of Initial and Current Intent	*-1.72**	*-2.714***	*-3.169***	

*p<.05 **p<.01

Additionally, a oneway ANOVA compared the differences across the three career orientations in Lieutenant responses to the career intent survey items. A significant difference, across all three career orientations, was found in initial career intent. The Bonferroni test result: for initial intent, management orientation responses were significantly different than project orientation responses; for current intent, there were no significant differences between responses.

The results of survey responses for AF CE captains regarding career intent are in Table 4.22. A significant difference in current and initial intent was apparent in the project career orientation.

Table 4.22 Comparison of Captain Survey Responses for Career Intent (by Career Orientation)

ITEMS 8 and 9	Project Response Mean (N=62)	Professional Response Mean (N=24)	Management Response Mean (N=145)	F Value (determined by oneway ANOVA)
Initial (at time of coming active duty) Intention toward making the Air Force a career.	2.45	2.46	2.49	.024
Current Intention toward remaining in the Air Force.	3.00	2.75	2.42	5.035**
T value for comparison of Initial and Current Intent	*-2.706***	*-.735*	*.533*	

**p<.01

Additionally, a oneway ANOVA test compared differences across the three career orientations in captain responses to the career intent survey items. A significant difference, across all three career orientations, was found in current career intent. The Bonferroni test indicated for initial intent, there were no significant differences between responses; for current intent, management orientation responses were significantly different than project orientation responses.

4.9 Summary

A summary of the research hypotheses tested is in Table 4.23. Differences were apparent across the engineer career orientations in the areas of graduate education, CESS

short courses, conferences/seminars, perceived limitations in career progression, career satisfaction and initial/current career intent therefore, the associated null hypothesis were rejected. No significant differences were apparent across the engineer career orientations in the areas of staffing and perceived organizational support therefore, the null hypothesis could not be rejected.

Table 4.23 Summary of Research Hypotheses

Hypothesis	**Status**	**Test**
Hypothesis 1: In the application of Allen and Katz's (1986) three taxonomic engineer types to Air Force CE CGOs, there is no difference in career orientations in Air Force CE CGOs.	Rejected	Test of Proportion
Hypothesis 2: Among Air Force CE CGOs, there is no difference in their current job and the availability of job positions for each of the three taxonomic types of engineers.	Not Rejected	Test of Proportion
Hypothesis 3a: Among Air Force CE CGOs, there is no difference in the desire and opportunity for graduate education for each of the three taxonomic types of engineers.	Rejected	Paired T-Test, ANOVA
Hypothesis 3b: Among Air Force CE CGOs, there is no difference in the desire and opportunity for CESS short courses for each of the three taxonomic types of engineers.	Rejected	Paired T-Test, ANOVA
Hypothesis 3c: Among Air Force CE CGOs, there is no difference in the desire and opportunity for conferences/seminars for each of the three taxonomic types of engineers.	Rejected	Paired T-Test, ANOVA
Hypothesis 4: Among Air Force CE CGOs, there is no difference in perceived limitations regarding engineer career orientations.	Rejected	ANOVA
Hypothesis 5: Among Air Force CE CGOs, there is no difference in career satisfaction in the three career orientations of project, professional, and management engineers.	Rejected	ANOVA
Hypothesis 6: Among Air Force CE CGOs, there is no difference in perceived organizational support in the three career orientations of project, professional, and management engineers.	Not Rejected	ANOVA
Hypothesis 7: Among Air Force CE CGOs, there is no difference between the initial and current intent towards a career in the Air Force for the three taxonomic types of engineers.	Rejected	Paired T-Test, ANOVA

Regression was used to determine the effect on current intent of all variables previously discussed: staffing, career orientation, graduate education, CESS short courses, conferences/seminars, career planning, career satisfaction, and perceived organizational support. In addition, gender was added as a control variable. For use in the regression, each variable received a distinct definition, Table 3.12.

Results of the multiple regression are in Table 4.24 and 4.25. The regression was run for Lieutenant data using the gender variable as a control, entering the test before all the other variables. The adjusted R square value for the gender and rank variables was 0.08. When the rest of the independent variables were entered into the regression the adjusted R square value was 0.30 which means that 30% of the variance in current career intent was explained by the regression equation. The results of the regression show that gender and career satisfaction are significant predictors of current career intent. However, only 22% (30-8) of the variance then is explained by the variables of interest with career satisfaction the only one of significance.

Next, a multiple regression was run for Captain data and the adjusted R square value for the gender and rank variables was .01. When the rest of the independent variables were entered into the regression the adjusted R square value was 0.45 which means that 45% of the variance in current career intent is explained by the regression equation. The results of the regression show that project orientation and career satisfaction are significant predictors of current career intent. However, only 44% (45-1) of the variance then is explained by the variables of interest with career satisfaction and project orientation as significant.

Table 4.24 Lieutenant Linear Regression Results (Current Career Intent is the Dependent Variable)

Independent Variable	Standardized Coefficient Beta	T value
Gender	.16	2.43*
Staffing	-.05	-.82
Project Orientation Dummy	-.06	-.74
Professional Orientation Dummy	.01	.10
Change in Career Orientation	.07	1.08
Graduate Education	.04	.58
Civil Engineer and Services School (CESS) Short Courses	.07	.92
Conferences/Seminars	-.03	-.36
Career Planning	-.03	-.45
Career Satisfaction	-.60	-6.47**
Perceived Organizational Support	.15	1.71

N=171 *p<.05 **p<.001 Adj R^2=.30 F value = 6.27 F value significance = .001

Table 4.25 Captain Linear Regression Results (Current Career Intent is the Dependent Variable)

Independent Variable	Standardized Coefficient Beta	T value
Gender	.07	1.46
Staffing	-.04	-.79
Project Orientation Dummy	.14	2.16*
Professional Orientation Dummy	.03	.65
Change in Career Orientation	-.09	-1.60
Graduate Education	-.06	-1.09
Civil Engineer and Services School (CESS) Short Courses	.09	1.58
Conferences/Seminars	.00	.04
Career Planning	-.06	-.91
Career Satisfaction	-.63	-9.60**
Perceived Organizational Support	.04	.58

N=403 *p<.05 **p<.001 Adj R^2=.45 F value = 19.44 F value significance = .01

As the regression results for both Lieutenants and Captains indicated career satisfaction as a significant indicator of current career intent, a regression test was completed with career satisfaction as the dependent variable. The regression was run for Lieutenant data (Table 4.26) using the gender variable as a control, entering the test before all the other variables. The adjusted R square value for the gender variable was 0.07. When the rest of the independent variables were entered into the regression the adjusted R square value was 0.50 which means that 50% of the variance in career satisfaction was explained by the regression equation. The results of the regression show that gender, project orientation, professional orientation, career planning and POS are significant predictors of career satisfaction. However, only 43% (50-7) of the variance then is explained by the variables of interest with project orientation, professional orientation, career planning and POS as significant predictors of career satisfaction.

The regression was run for Captain data (Table 4.27) using the gender variable as a control, entering the test before all the other variables. The adjusted R square value for the gender variable was 0.00. When the rest of the independent variables were entered into the regression the adjusted R square value was 0.59 which means that 59% of the variance in career satisfaction was explained by the regression equation. The results of the regression show that career planning and POS are significant predictors of career satisfaction.

Table 4.26 Results of Hierarchial Linear Regression of Multiple Independent Variables on Career Satisfaction (Lieutenant Sample)

Independent Variable	Standardized Coefficient Beta	T value
Gender	-.15	-2.6*
Staffing	-.06	-1.12
Project Orientation Dummy	-.26	-4.13**
Professional Orientation Dummy	-.12	-2.01*
Change in Career Orientation	.13	2.20*
Graduate Education	.03	.50
Civil Engineer and Services School (CESS) Short Courses	-.10	-1.67
Conferences/Seminars	.05	.87
Career Planning	.22	3.57**
Perceived Organizational Support	.44	6.87**

N=172 *p<.05 **p<.001 Adj R^2=.50 F value = 15.52 F value significance = .000

Table 4.27 Results of Hierarchial Linear Regression of Multiple Independent Variables on Career Satisfaction (Captain Sample)

Independent Variable	Standardized Coefficient Beta	T value
Gender	.03	.73
Staffing	.01	.17
Project Orientation Dummy	.035	.61
Professional Orientation Dummy	-.03	-.58
Change in Career Orientation	-.01	-.21
Graduate Education	.05	1.02
Civil Engineer and Services School (CESS) Short Courses	-.03	-.67
Conferences/Seminars	.03	.58
Career Planning	.15	2.82*
Perceived Organizational Support	.34	6.45**

N=231 *p<.05 **p<.001 Adj R^2=.59 F value = 30.95 F value significance = .000

V. Discussion

5.1 Retention of Air Force CE CGOs

This thesis was undertaken to explain why there is a shortage of Captains in the Civil Engineer career field. Specifically, this research effort examined the relationship between current Air Force HRM practices and "desired" (Lee and Maurer, 1997) standard HRM practices as applied to the retention of knowledge workers.

Air Force HRM practices in the areas of staffing, training and development, and career planning were addressed by this research effort. No mismatch between current Air Force HRM practices and "desired" HRM practices was found in the area of staffing. However, a mismatch did occur in the areas of training and development and career planning.

5.1.1 Air Force HRM Practices. Current job positions available to CE CGOs are meeting the manning requirements to match the breakdown of engineer types. This finding was not expected but could be due to errors in the process by which the researcher categorized each of the CE CGO job positions into one of the three career orientations. The categorization of job positions was based on the definitions and characteristics of each career orientation, however, no validation or further testing of this categorization was accomplished. Therefore, the subjective nature of the researcher's categorization of CE CGO job positions may have led to the finding that there is no mismatch between current Air Force HRM staffing practices and "desired" staffing practices.

That being said, the findings could indicate that the Air Force has an effective job variety and structure for its CE CGOs. Results of this research indicate that there is a substantial decrease in the amount of project engineers and an increase in management engineers when rank shifts from Lieutenants to Captains. The findings support the position of the Air Force in its CE officer development; generally stated the civil engineer officer career progression is one that initially builds depth through technical experience while increasing the job complexity, personal control and responsibility. Consequently, perhaps the staffing practices are encouraging Air Force CE CGOs that stay in to change their orientation to better align with the needs of the Air Force as the management orientation is seen as the only feasible means for career progression.

Lee and Maurer (1997) propose that the establishment of dual career ladders is a "desired" HRM practice when addressing career planning and the retention of knowledge workers. Additionally, Lee and Maurer (1997) propose that the establishment of a technical ladder is "desired" for retention of project and professional engineers while the establishment of a managerial ladder is "desired" for retention of management engineers. The analysis of perceived progression or limitation of each career orientation in regards to multiple career paths determines the fit between current Air Force HRM practices and the "desired" HRM practices discussed above.

Across the three career orientations, all most strongly agreed that the Air Force limits them to a career that is management oriented more so than project or professional oriented. This study also found that management engineers possessed a significantly higher perception than other engineers that the Air Force allows them to progress in the career orientation of their choice. This could indicate that the Air Force is

not practicing the "desired" HRM practice of offering multiple career paths in an effort to better retain knowledge workers. Consequently, the perceived limitation of the career field may result in reduced retention of Air Force CE CGOs, in the project and professional orientations. An additional negative affect on the retention of Air Force CE CGOs is their opportunity for training and development. In all training and development HRM practices addressed by this research, graduate education, CESS Short Courses and, conferences and seminars the participants had a low perception of opportunity relative to their desire for any type of training. Although Lee and Maurer (1997) proposed that a certain duration of training (i.e. graduate education versus short-term project-specific training) would better facilitate retention of specified career orientations, this was not evident as Air Force CE CGOs tended only to have strong preferences for technical versus management and desired any type of training, regardless of duration, that was offered.

These results might indicate that graduate education may be perceived as a necessary means for progression in all career orientations. Additional results in training and development indicate that there may be no real distinction between career orientations and the type of training (graduate vs. short courses) that is preferred. Consequently, all CE CGOs may desire any type of training and development in their respective preferences as means for personal gain through any educational development or career progression.

Additional analysis, between the desire to take CESS Short courses and the opportunity across all career orientations, resulted in the perceived opportunity not meeting the desire. Therefore, the Air Force is not perceived to be providing the

opportunity to take short courses desired by all orientations. As stated in the previous section on graduate education, there are several factors not addressed by this research in which a detailed explanation of why the opportunity for this type of training is not being met. However, one explanation may be the fact that the number of classes offered by the CESS was recently reduced. The survey participants' responses may reflect their knowledge of the occurrence and this notion is further supported by participant comments on the survey (Appendix G). Such as,

> In my first four years, I attended several AFIT short courses, some of which were the best engineering classes I've ever had. Now, the opportunities for these, even in the management related fields are few and far between.

Another comment reflecting this same notion,

> It is an absolute shame that the USAF has decided to discontinue technical short courses such as Power Systems Design at AFIT. Without the Power Systems Design course, I would not have been anywhere near as competent as I was after the course.

Interestingly, the funding for CESS short courses comes from AFIT and therefore many squadron commanders tended to favor sending their CE CGOs to CESS at the expense of AFIT instead of the squadron but now the opportunity to go has been minimized by the number of classes available. The same discontent is reflected in the results for conferences/seminars.

The results indicate that the strongest desire for conferences/seminars (grouped by project, profession and management) appears in the associated career orientation. In the analysis between the desire for conferences/seminars and the opportunity, across all career orientations the opportunity to take any type of conference/seminar did not meet

the desire. Evidently, CE CGOs perceive a lack of opportunity to attend conferences/seminars.

The findings on Conferences/Seminars further substantiate the differences in career orientation preferences for training and development (Lee and Maurer, 1997:247). Survey participant comments (Appendix G) provide insight to a reason for which the opportunity does not meet the desire for conferences: funding. The funding for any type of conference/seminars comes directly from squadron funds that are under the discretion of the squadron commander. It is the perception of some CE CGOs that the funding for this type of training is simply not available. For example, one survey comment stated, "The attitude after the continuing education courses at AFIT were discontinued was that the unit would fund local courses. This never happened for me because there is never enough money to spare".

5.1.2 Career Satisfaction and Perceived Organizational Support. The equivalence of career opportunities, in the form of different career paths, is measured by comparing levels of career satisfaction (Epstein, 1986:33). Career satisfaction, in this research effort, compares attitudes and perceptions pertaining to career opportunities within the Air Force.

The results of the career satisfaction analysis show that management engineers are significantly more satisfied than either project or professional engineers. This finding remains consistent as the population is broken down into Lieutenants and Captains. The findings are consistent with expected results due to 1) the Air Force general career progression for CE GGOs to jobs that are ultimately management oriented and 2) as

military members choose to progress to the next rank their career satisfaction should increase as they have chosen to remain and progress in the military.

As career satisfaction is the most significant predictor of current career intent, additional analysis was completed to better explain the predictors of career satisfaction. The results of the regression test on career satisfaction indicate that project orientation, professional orientation, POS and, perceived limitations towards career progression are significant ($p<.05$) indicators of career satisfaction for Lieutenants. Interestingly, the results for Captains indicate that POS and perceived limitations towards career progression are significant ($p<.05$) indicators of career satisfaction. Therefore, given these results in combination with the fact that both project and professional orientation percentages decrease from Lieutenant to Captain, indicate that perhaps the project and professional engineers that are most dissatisfied are getting out of the Air Force. Additional support for this notion is based on the career satisfaction response means; career satisfaction for project engineers increases when going from Lieutenant to Captain.

In support of this notion, of increasing multiple career track opportunities, the level of POS increases for both the professional and management orientations when going from Lieutenant to Captain but decreases for the project orientation. This decrease for level of POS for project oriented engineers was not expected but would serve to explain why the percentage of project oriented engineers are decreasing as rank increases. The decrease in project oriented engineers and their POS, as rank increases, may indicate that the current Air Force HRM career planning practices are not offering all the career progression tracts that are desired by their engineers. Consequently, Air Force CE CGOs that are project oriented may feel that the Air Force does not care as much about their

career progression. Therefore, the Air Force could look into clearly defining and offering a project orientation career tract if it is concerned about the retention of project oriented engineers.

5.1.3 Career Intent. Of the three career orientations, management engineers most strongly intended to make the Air Force a career upon initially entering the service. This could reflect their perception that officers are expected to be managers. This finding held true for the Lieutenant and Captain populations. Additionally, management engineers most strongly intend to make the Air Force a career at their current time in the service.

These results, regarding career intent reflects the lower level of career satisfaction experienced by project and professional engineers discussed previously. Additionally, regression results indicate that gender, rank and career satisfaction are significant predictors of current career intent: males, captains, and those that have a higher level of career satisfaction are more inclined to make the Air Force a career. These findings were expected as males are consistently a larger percentage of the military population and as stated earlier, as military members choose to progress to the next rank their career satisfaction should increase as they have chosen to remain and progress in the military. One other important predictor of the intent to remain was CGOs' willingness to change the orientation of their next job. For Lieutenants, those who were willing to change reported higher levels of intent to remain in the Air Force. Given the perception that management positions are more prevalent as one moves up in the Air Force, this may indicate a willingness to move into management positions, regardless of career orientation.

5.2 Limitations and Future Research

A limitation to this research lies in the application the common taxonomic types of engineers to military engineers. In early research of this breakdown of engineer career-orientation, data was collected in a study of engineers and scientists in nine major U.S. organizations (Allen and Katz, 1986:186). The data collection resulted in 2,157 usable questionnaires, of those, 1,495 respondents indicated a preference for one of the three taxonomic types of engineers, project, professional, or management (Allen and Katz, 1986:187). The respondents for the survey were initially classified as having a preference for orientation based on their response to one of the three scales exceeding the response to the two other scales by at least one scale point (Allen and Katz,1986:187). This research effort has attempted to refine the questioning and classification technique in determination of career classification. This effort was made to further the applicability of the career-orientation classification to all engineers. However, the limitation to one of the three types of engineers or a no match resulted in the omitence of any further classification of engineer. For instance, this research did not look into the possibility that 1) engineers could consider themselves as more than one type of engineer or 2) that engineers could be more associated with their organization, the Air Force, than with any other aspect in career progression. Therefore, there are several areas for which future research can be accomplished.

This thesis attempted to determine career orientation of Air Force CE CGOs by two measures: 1) survey participant self-categorization within an orientation using a single item measure and 2) a new measure containing several items intended to capture the given characteristics of each career orientation. The first measurement, of self-

categorization, was the measure used for analysis as the second measure was unable to differentiate the survey responses into three orientations. The survey responses to the items that used characteristic statements for orientation types, when factor analyzed led to categorization to only two types of engineers. Therefore, future research could improve this measure by further detailing and testing characteristics of engineer career orientations to lead to the categorization of project, professional and management orientations.

Additional areas in which future research could be accomplished are: the determination of better measures of HRM practices, the determination of the type of engineers that the Air Force would like to recruit for the future and, further implications for recruitment and selection based on engineer career orientation.

Appendix A

Civil Engineer Company Grade Officer
Job Positions in a Civil Engineer
Objective Squadron

Maintenance Engineering Flight

1. Maintenance Engineering Flight Chief/Deputy
2. Utility/Energy Engineer
3. Mechanical/Electrical Engineer

Engineering Flight

1. Engineering Flight Chief/Deputy
2. Simplified Acquisition of Base Engineer Requirements (SABER) Chief/Deputy
3. Programmer
4. Project Manager
5. Design Engineer
6. Architect

Environmental Flight

1. Environmental Flight Chief/Deputy
2. Program Manager

Resource Flight

1. Resource Flight Chief
2. member

Explosive Ordinance Disposal (EOD) Flight

1. EOD Flight Chief

Readiness Flight

1. Readiness Flight Chief
2. member

Other:

1. Section Commander/Executive Officer
2. Career Broadening position

Appendix B

Degrees Offered at the Air Force Institute of Technology (AFIT)

AFIT In Resident

Master of Science Degrees offered:
Aeronautical Engineering (ABET)
Applied Mathematics
Applied Physics
Astronautical Engineering (ABET)
Computer Engineering (ABET)
Computer Systems
Electrical Engineering (ABET)
Electro-Optics (ABET)
Engineering and Environmental Mgmt
Environmental Science and Engineering
Material Science and Engineering
Meteorology
Nuclear Engineering (ABET)
Operational Analysis
Operations Research
Space Operations
Systems Engineering (ABET)
Acquisition Logistics Management Program
Air Mobility Program
Contracting Management Program
Cost Analysis Program
Information Resource Management Program
Information Systems Management Program
Logistics Management Program
Software Systems Management Program
Supply Management Program
Systems Management Program
Transportation Management Program

The Doctor of Philosophy in Engineering is offered in the following specialty areas:

Aeronautical Engineering
Applied Mathematics
Astronautical Engineering
Computer Engineering
Computer Systems
Electrical Engineering
Electro-Optics
Engineering Physics
Nuclear Engineering
Operations Research

Civilian Institute Programs (CI)

Graduate Education Programs
AF Special Professional Continuing Education Program
Chaplain Advanced Education Program
Education With Industry (EWI)
Educational Delay Program
Graduate/Post-Graduate Degrees
Instructor Programs
Legal Education

Appendix C
AFIT In Resident Engineering and Environmental Management Graduate Degree Program
http://en.afit.af.mil/env/geedesc.htm

Application Sequences within the Curriculum
Student must choose one of five:

1. Human Resource Management Sequence

The Human Resource Management sequence reinforces the technical manager's understanding of individual behavior and group dynamics within the organizational environment.

2. Quantitative Decision Making Sequence

The essence of management is informed decision-making. The Quantitative Decision-Making Sequence provides the student with tools capable of facilitating the decision-making process in the face of uncertainty, risk, and differing value systems.

3. Program and Contract Management Sequence

Engineering management increasingly involves accomplishing tasks through contractual mechanisms. Understanding the various types of contracts and their relative advantages is fundamental to effective and efficient selection processes. The unique context of federal contracting and budgeting also inherently affects the viability of projects and programs executed through these contracting instruments.

4. Applied Environmental Sciences Sequence

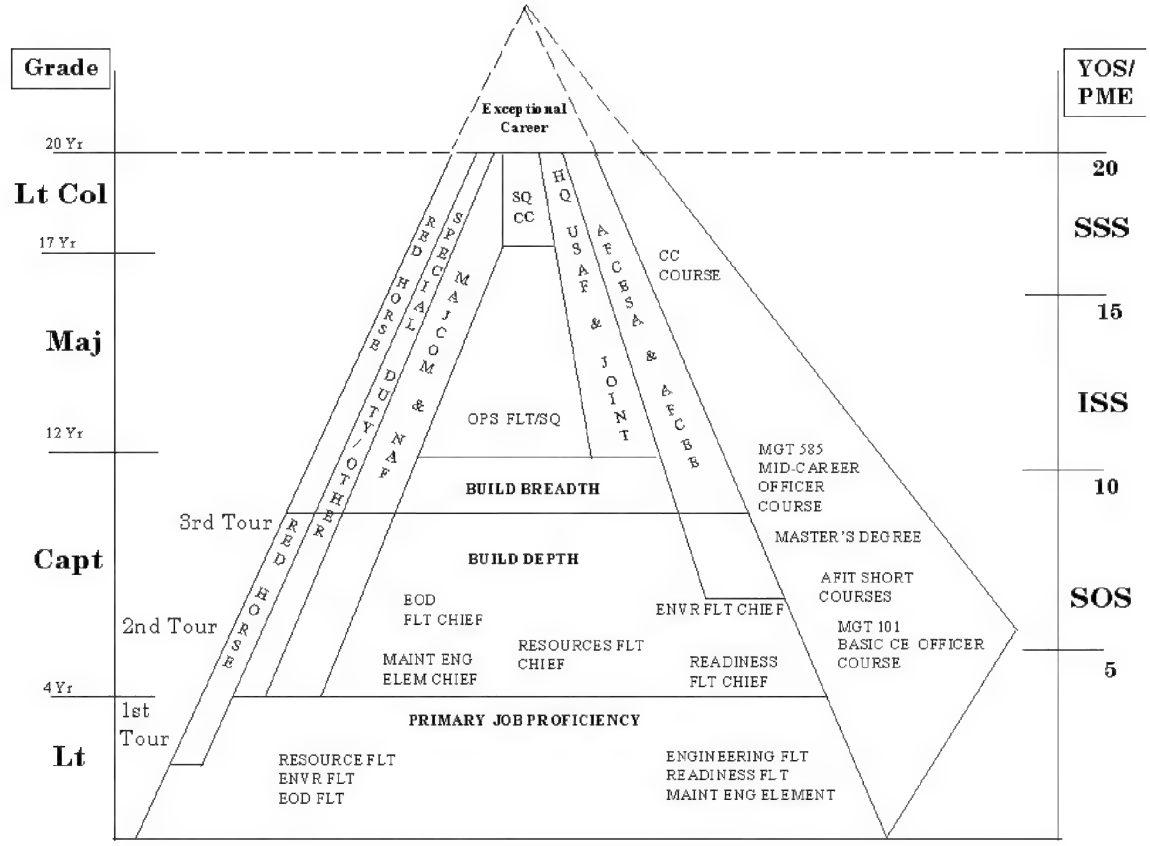
The Applied Environmental Sciences sequence expands competencies in resolving environmental contamination problems associated with Air Force facilities and operations. The sequence builds on the core environmental courses that provide a foundation for understanding regulatory, ecosystem, and health requirements for mitigation and remediation of contaminants.

5. Environmental Systems Analysis and Management Sequence

Explores the behavior of complex environmental systems, both as they exist in nature and as they are altered in engineering design to enhance productivity or reduce loss. The sequence emphasizes a holistic approach to understanding the behavior of the integrated whole which is made up of complex interrelated influences. The principles of system dynamics modeling from the core curriculum are heavily used.

Appendix D

Civil Engineer Career Pyramid



Abbreviation Used Above:

Lt	Lieutenant	**OPS**	Operations
Capt	Captain	**MAINT ENG**	Maintenance Engineering
Maj	Major	**SQ**	Squadron
Lt Col	Lieutenant Colonel	**MAJCOM**	Major Air Command
USAF	United States Air Force	**ENVR**	Environmental
YOS	Years of Service		
PME	Professional Military Education		
SOS	Squadron Officer School		
ISS	Intermediate Service School		
SSS	Senior Service School		
EOD	Explosive Ordinance Disposal		
AFCESA	Air Force Civil Engineer Support Agency		

Appendix E

Engineer Career Orientation Pilot Survey

1st Lt Cynthia M. Davis
AFIT/ENV
Bldg 640
2950 P Street
Wright-Patterson AFB OH 45433-7765

Dear Survey Participant

This survey is part of a research effort to learn more about the career orientation of Air Force engineers, Air Force Human Resource management practices, and retention. The objective of this survey is to determine the breakdown of military engineer types and gather information regarding current Air Force Human Resource Management (HRM) practices. The application of current HRM and turnover research, to the compiled data, will enable a determination of the extent current military HRM practices are facilitating the retention of knowledge workers.

Your reply will be treated in strict confidence and will be available only to my research advisor and myself. In addition, when the results of this study are published, readers will not be able to identify specific individuals. Results of this survey will be available upon request to the researcher.

Your assistance will be greatly appreciated and will aid in furthering this research.

Thank you for your cooperation in participating in this study. If you have any questions, please contact the researcher, 1st Lt Cynthia M. Davis, at the address above.

Sincerely

Cynthia M Davis

CYNTHIA M. DAVIS
Master's Candidate, Dept of Environmental
and Engineering Management
Graduate School of Engineering
Air Force Institute of Technology

Engineer Career Orientation

INSTRUCTIONS

All items must be answered by filling in the appropriate spaces directly on the survey itself or by writing a response in the space provided. If, for any item, you do not find a response that fits your situation exactly, use the one that is the closest to the way you feel.

PART I: BACKGROUND INFORMATION

1. What is your gender?
O male O female

2. What is your duty Air Force Specialty Code (AFSC), i.e., the authorized manning position to which you are currently assigned? (Please fill in ONE circle).

O 32EXX O Other

3. What is your current duty title?

_____

4. Indicate your rank:
O Second Lieutenant O First Lieutenant O Captain O Major

5. How long have you been on active duty in the Air Force? (please fill in the blanks with the number of years and the number of months __4__ years __7__ months)

_____ years and _____ months

PART II: CAREER ORIENTATION

Research on the career-orientation of engineers have categorized engineers into three career-based prototypes:

1. *Project Engineer*: a person that is primarily project-oriented and can be described as most involved with and attached to a specific project

2. *Professional Engineer*: a person that is primarily profession-oriented and can be described as most involved and attached to the professional norms and ethics, and the role of engineering

3. *Management Engineer*: a person that is primarily oriented towards management and can be described as more involved and attached to the role of manager

6. *Based on the definitions above:*
For each statement, please fill in the circle for the number that indicates the type of engineer that the statement best describes. Use the scale below for your responses.

	1 Project Engineer	2 Professional Engineer	3 Management Engineer	4 No match
a. It is important to me that my technical knowledge remains current.	①	②	③	④
b. I want my career to advance to a policy-making position.	①	②	③	④
c. I want my career to be attached to the occupation of engineering.	①	②	③	④
d. I want my career to be involved with several specific projects.	①	②	③	④
e. An important opportunity of the engineering profession is the advancement of technical knowledge.	①	②	③	④
f. I want my career to be involved in addressing complex technical problems.	①	②	③	④
g. An important opportunity of the engineering profession is the ability to work in several task areas.	①	②	③	④
h. I enjoy working on technical problems.	①	②	③	④
i. I am not concerned with my career progressing to the management level.	①	②	③	④
j. It is important to me that my knowledge of supervisory skills and practices remains current.	①	②	③	④
k. An important opportunity of the engineering profession is the advancement of supervisory skills.	①	②	③	④
l. I want my career to be attached to my upward mobility in supervision.	①	②	③	④
m. It is important to me that I expand my knowledge in areas that are focused on specific tasks.	①	②	③	④
n. I want my career to be attached to the role of a manager.	①	②	③	④
o. I enjoy working on several diversified tasks.	①	②	③	④
p. I enjoy working in a supervisory capacity.	①	②	③	④

7. Based on these definitions, how would you best describe your orientation for engineering?

O project-oriented O profession-oriented
O management-oriented O can't decide (*skip to question 9*)

8. Based on the type of engineer that you identified yourself with, do you think thatyour current job matches your engineer-orientation type? (for example: You identified yourself as a management engineer and your current job is as the base utilities engineer officer- therefore your current job does not match your career orientation)

O yes O no O I do not know

9. Which type of orientation most closely matches the orientation that you want your next job to be?

O project-oriented O profession-oriented O management-oriented
O no preference

PART III: CAREER SATISFACTION

10. For each statement, please fill in the circle for the number that indicates the extent to which you agree the statement is true. Use the scale below for your responses.

1 Strongly disagree	2 Moderately disagree	3 Slightly disagree	4 Neither disagree nor agree	5 Slightly agree	6 Moderately agree	7 Strongly agree

a. The opportunities for advancement in the Air Force are suited to my personal career goals. ① ② ③ ④ ⑤ ⑥ ⑦

b. In general, I am satisfied with my career. ① ② ③ ④ ⑤ ⑥ ⑦

c. My skills and abilities arewell-suited to my career choice. ① ② ③ ④ ⑤ ⑥ ⑦

PART IV: CAREER INTENT

11. Indicate the response that most closely matches yourcurrent intentions toward remaining in the Air Force.

O I will definitely remain in the Air Force.
O I will probably remain in the Air Force.
O I am undecided as to whether I will remain in or separate from the Air Force.
O I will probably separate from the Air Force.
O I will definitely separate from the Air Force.

12. Indicate the response that most closely matches your intention toward making the Air Force a careerat the time you came on active duty.

O I definitely intended to make the Air Force a career.
O I most likely intended to make the Air force a career.
O I was undecided
O I most likely did not intend to make the Air force a career
O I definitely did not intend to make the Air Force a career

PART V: TRAINING AND DEVELOPMENT

13. For these statements, please fill in the circle for the number that indicates the extent to which you agree the statement is true. Use the scale below for your responses.

1 Strongly disagree	2 Moderately disagree	3 Slightly disagree	4 Neither disagree nor agree	5 Slightly agree	6 Moderately agree	7 Strongly agree

a. The Air Force allows me ample opportunity to pursue a technical Masters Degree.	① ② ③ ④ ⑤ ⑥ ⑦
b. The Air Force allows me ample opportunity to pursue a business Masters Degree.	① ② ③ ④ ⑤ ⑥ ⑦
c. The Air Force allows me ample opportunity to take short courses at the Civil Engineer and Services School.	① ② ③ ④ ⑤ ⑥ ⑦
d. The Air Force allows me ample opportunity to attend management conferences/seminars offered by businesses and educational institutes.	① ② ③ ④ ⑤ ⑥ ⑦
e. The Air Force allows me ample opportunity to attend technical conferences/seminars that are oriented towards expanding my engineering knowledge base.	① ② ③ ④ ⑤ ⑥ ⑦
f. The Air Force allows me ample opportunity to attend conferences/seminars that are oriented towards expanding my knowledge regarding a specific project.	① ② ③ ④ ⑤ ⑥ ⑦
g. I am aware of the educational opportunities that are available to me.	① ② ③ ④ ⑤ ⑥ ⑦
h. The educational opportunities that are available to me meet all my educational needs.	① ② ③ ④ ⑤ ⑥ ⑦
i. I wish to have a technical Masters Degree.	① ② ③ ④ ⑤ ⑥ ⑦
j. I wish to have a business Masters Degree.	① ② ③ ④ ⑤ ⑥ ⑦
k. I would like to take management short courses at the Civil Engineer and Services School.	① ② ③ ④ ⑤ ⑥ ⑦
l. I would like to take project-specific short courses at the Civil Engineer and Services School.	① ② ③ ④ ⑤ ⑥ ⑦
m. I would like to take profession oriented short courses at the Civil Engineer and Services School.	① ② ③ ④ ⑤ ⑥ ⑦
n. I would like to attend management conferences/seminars offered by businesses and educational institutes.	① ② ③ ④ ⑤ ⑥ ⑦
o. I would like to attend technical conferences/seminars that are oriented towards expanding my engineering knowledge base.	① ② ③ ④ ⑤ ⑥ ⑦
p. I would like to attend conferences/seminars that are oriented towards expanding my knowledge regarding a specific project.	① ② ③ ④ ⑤ ⑥ ⑦

14. What type of Master's Degree do you have?

O Master of Science
O Masters of Business Administration
O Other
O I do not have a Master's Degree

15. What type of Master's Degree are you currently working on?

O Master of Science
O Master of Business Administration
O Other
O I am not currently working on a Master's Degree

16. Through what type of program did you attain, or are you attaining, your Master's Degree?*(you can fill in more than one, additionally, to the right of the program type write in what type of degree was earned through each program)*

O I have not attained, or wish to attain a Master's Degree
O Air Force Institute Of Technology Graduate Program
O Air Force tuition assisted (i.e. 75% of tuition paid for by the Air Force)
O Paid for your degree without financial assistance from the Air Force
O Other

PART VI: CAREER PLANNING

17. Based on the expectations of the Air Force, these statements address your perceptions regarding career paths. For each statement, please fill in the circle for the number that indicates the extent to which you agree the statement is true. Use the scale below for your responses.

	1 Strongly disagree	2 Moderately disagree	3 Slightly disagree	4 Neither disagree nor agree	5 Slightly agree	6 Moderately agree	7 Strongly agree
a. The Air Force allows me to progress in the career orientation of my choice.	①	②	③	④	⑤	⑥	⑦
b. The Air Force limits me to a career that is project-oriented.	①	②	③	④	⑤	⑥	⑦
c. The Air force limits me to a career that is profession-oriented.	①	②	③	④	⑤	⑥	⑦
d. The Air Force limits me to a career that is management-oriented.	①	②	③	④	⑤	⑥	⑦
e. The Air Force does not limit me to a specific career-orientation.	①	②	③	④	⑤	⑥	⑦

18. Do you feel that the information you received accurately portrayed the CE Officer career guidance you have received since entering active duty?

O yes O no O I was not briefed before becoming active duty

This completes the survey. Thank you for your participation.
If you have any additional comments please write them here.

Appendix F

Engineer Career Orientation Survey

Col Lance Brendel
HQ AFCESA/CEO
139 Barnes Drive Suite 1
Tyndall AFB FL 32403-5319

Dear fellow Civil Engineer Officers,

The Air Force Civil Engineer Support Agency is determined to maximize Air Force civil engineer capabilities in base and contingency operations. As part of the effort to reach this goal, the agency must clearly understand the demographics and associated needs of its civil engineer personnel. The attached survey is an effort to collect information specifically targeting career orientation of Air Force engineers, Air Force Human Resource management practices, and retention.

Please take 10-15 minutes to complete this important survey. Your participation is essential to ensure that we're doing everything we can to support our engineers.

LANCE C. BRENDEL, Colonel, USAF
Director CEO Operations Support
Air Force Civil Engineer Support Agency

Engineer Career Orientation Survey

INSTRUCTIONS

The objective of this survey is to determine the breakdown of military engineer types and gather information regarding current Air Force Human Resource Management (HRM) practices. The application of current HRM and turnover research, to the compiled data, will enable a determination of the extent current military HRM practices are facilitating the retention of engineers. This survey has been approved by the Survey Branch, Air Force Personnel Center and is assigned the survey control number (SCN): USAF SCN 99-86.

Please answer all items by filling in the appropriate spaces directly on the survey itself or by writing a response in the space provided. If, for any item, you do not find a response that fits your situation exactly, use the one that is the closest to the way you feel.

Your reply will be treated in strict confidence and will be available only to the researcher and the research advisor. In addition, when the results of this study are published, readers will not be able to identify specific individuals. Results of this survey will be available upon request to the researcher.

Thank you for your cooperation in participating in this study. If you have any questions, please contact the researcher at the following address:

1st Lt Cynthia M. Davis
AFIT/ENV BLDG 640
2950 P Street
Wright-Patterson AFB OH 45433-7765
Email: Cynthia.Davis@afit.af.mil
Phone: DSN 785-3636, ext. 6182, commercial (937) 255-3636, ext. 6182

PART I: BACKGROUND INFORMATION

1. What is your gender?
   O male O female

2. What is your duty Air Force Specialty Code (AFSC), i.e., the authorized manning position to which you are currently assigned? (Please fill in ONE circle).
   O 32EXX O Other

3. What is your current duty title?

   _____

4. What Major Command are you currently assigned to?

   _____

5. Indicate your rank:
   O Second Lieutenant O First Lieutenant O Captain O Major

6. How long have you been on active duty in the Air Force? (please fill in the blanks with the number of years and the number of months)

   _____ years and _____ months

PART II: CAREER OUTLOOK

7. For each statement, please fill in the circle for the number that indicates the extent to which you agree the statement is true. Use the scale below for your responses.

	1 Strongly disagree	2 Moderately disagree	3 Slightly disagree	4 Neither disagree nor agree	5 Slightly agree	6 Moderately agree	7 Strongly agree
a.	It is important that my technical knowledge remains current.						
b.	I want my career to be attached to the occupation of engineering.						
c.	The Air Force strongly considers my goals and values.						
d.	I want my career to be involved with several specific projects.						
e.	An important opportunity of the engineering profession is the advancement of technical knowledge.						
f.	Help is available from the Air Force when I have a problem.						
g.	The opportunities for advancement in the Air Force are suited to my personalcareer goals.						
h.	I want my career to be involved in addressing complex technical problems.						
i.	The Air Force takes pride in my accomplishments at work.						
j.	An important opportunity of the engineering profession is the ability to work on diverse technical tasks.						
k.	The Air Force really cares about mywell-being.						
l.	I enjoy working on problems specific to my engineering discipline.						
m.	Moving up in the Air Force is not important to me.						
n.	The Air Force is willing to extend itself in order to help me perform my job tothe best of my ability.						
o.	It is important that my knowledge of supervisory skills and practices remains current.						
p.	In general, I am satisfied with my career.						
q.	An important opportunity of the engineering profession is the advancementof supervisory skills.						
r.	Even if I did the best job possible, the Air Force would fail to notice.						
s.	I want my career to be attached to my upward mobility in supervision.						
t.	It is important that I expand my knowledge in areas focused on specific tasks.						
u.	I want my career to be attached to the role of a manager.						
v.	The Air Force cares about my general satisfaction at work.						
w.	I enjoy working on diverse technical tasks.						
x.	My skills and abilities arewell-suited to my career choice.						
y.	The Air Force shows very little concern for me.						
z.	I want my career to be attached to upholding engineering norms and ethics.						
aa.	The Air Force cares about my opinions.						
bb.	I enjoy working in a supervisory capacity.						

8. Indicate the response that most closely matches your current intentions toward remaining in the Air Force.

O I will definitely remain in the Air Force.
O I will probably remain in the Air Force.
O I am undecided as to whether I will remain in or separate from the Air Force.
O I will probably separate from the Air Force.
O I will definitely separate from the Air Force.

9. Indicate the response that most closely matches your intention toward making the Air Force a career at the time you came on active duty.

O I definitely intended to make the Air Force a career.
O I most likely intended to make the Air force a career.
O I was undecided
O I most likely did not intend to make the Air force a career
O I definitely did not intend to make the Air Force a career.

Research on the career-orientation of engineers have categorized engineers into three career-based prototypes:

1. ***Project Engineer*:** a person that is primarily project-oriented and can be described as most involved with and attached to a specific project or several specific projects

2. *Professional Engineer*: a person that is primarily profession-oriented and can be described as most involved and attached to the professional norms and ethics, and the role of engineering

3. ***Management Engineer*:** a person that is primarily oriented towards management and can be described as more involved and attached to the role of manager

10. Based on the definitions above, how would you best describe your orientation for engineering?

O project-oriented O profession-oriented
O management-oriented O can't decide (*skip to question 12*)

11. Based on the type of engineer that you identified yourself with, to what extent does your current job match your engineer-orientation type? (for example: You identified yourself as a management engineer and your current job is as the base utilities engineer officer- therefore your current job does *not at all* match your career orientation)

O Completely O a large extent O somewhat O very little O not at all

12. Which type of orientation most closely matches the orientation that you want your next job to be?

O project-oriented O profession-oriented O management-oriented
O no preference

PART III: CAREER PLANNING

13. Based on the expectations of the Air Force, these statements address your perceptions regarding career paths. For each statement, please fill in the circle for the number that indicates the extent to which you agree the statement is true. Use the scale below for your responses.

1 Strongly disagree	2 Moderately disagree	3 Slightly disagree	4 Neither disagree nor agree	5 Slightly agree	6 Moderately agree	7 Strongly agree

a. The Air Force allows me to progress in the career orientation of my choice.	① ② ③ ④ ⑤ ⑥ ⑦
b. The Air Force limits me to a career that is project-oriented.	① ② ③ ④ ⑤ ⑥ ⑦
c. The Air force limits me to a career that is profession-oriented.	① ② ③ ④ ⑤ ⑥ ⑦
d. The Air Force limits me to a career that is management-oriented.	① ② ③ ④ ⑤ ⑥ ⑦
e. The Air Force does not limit me to a specific career-orientation.	① ② ③ ④ ⑤ ⑥ ⑦
f. The information I received, before coming on active duty, matches the CE Officercareer guidance I have received since entering active duty.	① ② ③ ④ ⑤ ⑥ ⑦

PART IV: TRAINING AND DEVELOPMENT

14. For these statements, please fill in the circle for the number that indicates the extent to which you agree the statement is true. Use the scale below for your responses.

1 Strongly disagree	2 Moderately disagree	3 Slightly disagree	4 Neither disagree nor agree	5 Slightly agree	6 Moderately agree	7 Strongly agree

a. The Air Force allows me ample opportunity to pursue a technical Masters Degree.	① ② ③ ④ ⑤ ⑥ ⑦
b. The Air Force allows me ample opportunity to pursue a business Masters Degree.	① ② ③ ④ ⑤ ⑥ ⑦
d. The Air Force allows me ample opportunity to take short courses at the Civil Engineer and Services School.	① ② ③ ④ ⑤ ⑥ ⑦
e. The Air Force allows me ample opportunity to attend management conferences/seminars offered by businesses and educational institutes.	① ② ③ ④ ⑤ ⑥ ⑦
e. The Air Force allows me ample opportunity to attend technical conferences/seminars that are oriented towards expanding my engineering knowledge base.	① ② ③ ④ ⑤ ⑥ ⑦
f. The Air Force allows me ample opportunity to attend conferences/seminars thatare oriented towards expanding my knowledge regarding a specific project.	① ② ③ ④ ⑤ ⑥ ⑦
g. I am aware of the educational opportunities that are available to me.	① ② ③ ④ ⑤ ⑥ ⑦
h. The educational opportunities that are available to me meet all my educational needs.	① ② ③ ④ ⑤ ⑥ ⑦
i. I wish to have a technical Masters Degree.	① ② ③ ④ ⑤ ⑥ ⑦

	1 Strongly disagree	2 Moderately disagree	3 Slightly disagree	4 Neither disagree nor agree	5 Slightly agree	6 Moderately agree	7 Strongly agree

j.	I wish to have a business Masters Degree.	①	②	③	④	⑤	⑥	⑦
k.	I would like to take management short courses at the Civil Engineer and Services School.	①	②	③	④	⑤	⑥	⑦
l.	I would like to take project-specific short courses at the Civil Engineer and Services School.	①	②	③	④	⑤	⑥	⑦
m.	I would like to take profession oriented short courses at the Civil Engineer and Services School.	①	②	③	④	⑤	⑥	⑦
n.	I would like to attend management conferences/seminars offered by businesses and educational institutes.	①	②	③	④	⑤	⑥	⑦
o.	I would like to attend technical conferences/seminars that are oriented towards expanding my engineering knowledge base.	①	②	③	④	⑤	⑥	⑦
p.	I would like to attend conferences/seminars that are oriented towards expanding my knowledge regarding a specific project.	①	②	③	④	⑤	⑥	⑦

15. What type of Master's Degree do you have?

O Master of Science O Masters of Business Administration
O Other O I do not have a Master's Degree

16. What type of Master's Degree are you currently working on?

O Master of Science O Master of Business Administration
O Other O I am not currently working on a Master's Degree

17. Through what type of program did you attain, or are you attaining, your Master's Degree? *(you can fill in more than one, additionally, to the right of the program type write in what type of degree was earned through each program)*

O I have not attained, or wish to attain a Master's Degree
O Air Force Institute Of Technology Graduate Program (in residence) _____
O Air Force Institute Of Technology Civilian Institute Program _____
O Air Force tuition assisted (i.e. 75% of tuition paid for by the Air Force) _____
O Paid for your degree without financial assistance from the Air Force _____
O Other _____

This completes the survey. Thank you for your participation.
If you have any additional comments please write them here.

_____
_____
_____
_____

Appendix G

Engineer Career Orientation Survey
Participant Comments

No Need for an Engineering Degree

The Air Force does not allow enough opportunity to keep technical engineering knowledge current. I did not need an engineering degree to be in CE.

The Air Force wants managers, and that is fine. However, I am watching our technical ability as engineers erode. Outsourcing, privatization, and design contracts have contributed to this. My current job and others I have held in this squadron don't require a degree in engineering. Any reasonably intelligent person could do it. Why require technical skills if you are not going to use them? I'm a civil engineer and my current job requires me to be a lawyer. There are a few jobs where engineers can get practical experience (REDHORSE comes to mind) but they are generally hard to come by. Maybe the problem is only within AETC. I don't know. It frustrates me. If you are looking to retain engineers, make them feel like engineers. Throw them a technical bone (or a class) every now and then. Even as an engineer manager, you have to have some idea of what is going on. At least they won't feel like they wasted 4-5 years of college getting an engineering degree.

I think some technical engineering knowledge is required even as we progress into manager oriented jobs to maintain some credibility as engineers. Otherwise, why require an engineering degree to be a 32EXX officer?

Professional Engineer Registration

I do not believe the Air Force is helping young Lts work towards a Professional Engineer License. The Air Force is doing discredit to all engineers by not helping and developing its officers to be P.E.s.

What about recognition and encouragement for Professional Registration? As a PE, registration is paramount for an engineer officer or engineer in the civil sector.

Would like to see Professional Engineer (PE) prep classes offered and/or paid for. I knew of one CE officer assigned to a Weapon System SPO whose office paid for a PE prep class. They felt it was important to his professional development.

When will the Air Force come up with a program to assist CE officers in Professional Registration?

Unlike the Navy (Engineering Officer Corps) the Air Force calls not for professional development, advanced education and licensing for uniformed personnel. A Navy

engineer (as an Ensign or Lieutenant) is to get their professional registration soon thereafter.

I would like more information on opportunities to pursue a PE license.

I enjoy the management aspect the USAF provides, but I wish therewas more support for gaining Professional Registration. I want to be a technically competent, registered Professional Engineer, engineering manager.

Training Limitations

The attitude after the continuing education courses at AFIT were discontinued was that the unit would fund local courses. This never happened for me because there is never enough money to spare. The Air Force does not enforce the importance of continuing education for engineers- our way to maintain proficiency especially when not much opportunity exists to gain technical experience in base and contingency operations. The Air Force should hire construction managers and managers, not engineers for the 32EXX career field if it is not willing to come up with the cash or types of jobs engineers want.

My previous organization encouraged professional continuing education in Contract Management and Project Management and offeredweek long short courses every 2-3 months. Our leader was committed to offering classes to allwho desired them. In other organizations, funding limits are such that we may have one opportunity per year for a short course.

While I enjoy working technical issues- the best career mobility, as well as the most enjoyment for me is in the engineering management. it affords an opportunity to be involved in larger projects and responsibilities. However, I don't feel that the Air Force provides enough CE related educational opportunities. I've been on active duty for over 10 years, and have gained much experience. In my first four years, I attended several AFIT short courses, some of which were the best engineering classes I've ever had. Now, the opportunities for these, even in the management related fields are few and far between. As for attending industry courses, training budgets really don't allow for that either. Time is another issue. Now, because of manpower restriction, it is very hard for a unit to be without personnel for an extended time. Professional development is critical to meeting requirements of a resource restricted Air Force. In the years since I've been active duty, advances in computer-aided design, drafting, and modeling have made it possible to do so much more with our resources- but I have not received any training in these areas at all. Also, I feel that the Air Force should make a significant effort towards getting its engineers a professional license. Never in my career have I ever been offered or heard of any assistance in this area. While I have felt that I should wait and gain experience, now I am ready but will have to wade through everything on my own. Resources will only get tighter, and training and education are the keys to success. I hope that senior Air Force CE leaders enhance training opportunities and get the word out.

When you have a civilian supervisor, he sees military as temporary help and does not want to invest any training for you. Therefore all the civilians get training and courses. There is definitely a double standard.

Graduate Education

I think professionals like engineers, pilots, doctors, and lawyers should get incentive pay for receiving their Masters. Doctors and lawyers start out as Captains, why can't those with Masters coming in the Air Force either start as 1st Lieutenants or receivean incentive pay? I could make over twice as much as I make in the civilian world.

I believe the Air Force would improve retention of Civil Engineer officers if advanced degrees were offered only at civilian institutes and if a greater percentage of CE officers were able to take advantage of the program.

AFIT should expand its Master of Science degree programs to allow additional engineering degrees that are not currently offered.

The Air Force should allow all of its CE officers to pursue a quality Masters Degree at a Civilian Institution.

Degree programs are limited for technical management overseas. I have started a Masters (tuition assistance) in Mgmt (MS) but I have not been able to take classes in 2 yrs because the program is not offered at my current duty location.

Short Course offered by AFIT Civil Engineer and Services School

It is an absolute shame that the USAF has decided to discontinue technical short courses such as Power Systems Design at AFIT. Without the Power Systems Design course, I would not have been anywhere near as competent as I was after the course. In fact, I passed my Electrical Professional Engineer Exam on the first try and I only took my power system design course notes, the NEC handbook, and a couple of IEEE books into the exam.

I would like to see more technical, design oriented courses offered by AFIT. Currently, there is only Pavement and Design, which was a great course, but other design courses would be helpful as well (concrete, sewers, roofs, etc.) Most civil engineers have familiarity with these topics, but an Air Force slant is beneficial.

Management Track

I consider myself fortunate to have been able to immerse myself in technically based civil positions. I know many that wanted to, but were forced to other quasi-"management" positions. The coin-toss way the Air Force decides where/which positions you will fill is crazy to me- hence the decision to exit.

I love project engineering but realize that as an officer I must get more into management; CE is becoming management of base appearance, not infrastructure

Issues not addressed by this Survey

My emphasis/career and my profession is that of an officer, not an engineer. I didn't see a place to express that in your survey. The fact that I have 2 degrees in engineering is secondary to being an officer.

Your definition of profession, project, and management- orientation were slightly confusing. What about the profession of arms- is that management or profession?

Why do you assume we want to be Engineers and Managers? How about using the concept of an Engineer and a Leader, not just someone who writes specifications and contracts.

Civil Engineer Career Field: Present and Future

As A-76 efforts continue within CE, what plans does the career field have to accommodate the "displaced" officers? With Chief of Operations positions going away with each A-76, where can CE majors go for equally challenging opportunities?

The Air Force is very selective when it comes to their "real" engineers. This is true of specialized positions and higher education. We base-level engineers are all management oriented. For some , that's fine; however, more and more leadership opportunities are being pulled from CGOs and being filled by Senior NCOs. My nearly 10 years all at base level have created the following impressions:

Leaders = Field Grade Officers and Senior NCOs
Engineers + Contractors and select Officers
CE Company Grade Officers = Program/Problem Managers

The Civil Engineering career field limits mechanical engineers to HVAC and management. Mechanical engineers mostly learn in school what would help them in the 62EXX or 63EXX career field of the Air Force.

Most Air Force CE duties provide superb management opportunities. Balancing this with continuing technical education creates well rounded and marketable engineers.

General Comments

While technical know-how is important to CE officers, the skills I have noticed most lacking are the abilities to effectively speak and write and properly manage subordinates.

There is CE information (career guidance) out there (i.e. AFCESA) but not publicized at all and goes to waste without new Lts having the opportunity to utilize it.

I think that CE officers need to be made aware of all of the job opportunities available to them; whether it's at base level, MAJCOM, or DRUs. Especially if they have a specific title like Mechanical Engineer or Architect.

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ABSTRACT (*Maximum 200 Words*)

Turnover of the Air Force civil engineering (CE) officers is becoming increasingly important, as levels of CE Captains consistently decreases. Allen and Katz (1986) identified three career orientations of engineers based on their job preference—project, professional, and management engineers. Shepard (1958) suggested a dual-ladder promotion system to meet the career desires of technical and management workers. Additional research has proposed "desired" Human Resource Management (HRM) practices to facilitate the retention of each type of career-based engineer (Lee and Maurer, 1997). In an effort to determine if these career orientations, along with Air Force HRM practices, were linked to declining retention, a survey was sent to 927 CE company grade officers (CGO) to measure these and other variables of interest including career satisfaction, perceived organizational support and participant's intent to remain in the Air Force.

Results of the analysis revealed 50 percent of respondents were management oriented, 37 percent were project oriented, and 13 percent professional oriented. Management oriented CE officers reported higher levels of career satisfaction and intent to remain in the Air Force than the other two orientations. Additional findings suggest that career orientation and HRM practices are important considerations for improving the retention of Air Force CE CGOs.

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